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EDWARD TELLER

BOX NO. 488 304/06

ACCESSION NO. 76074-~~271~~

(2)

EDWARD TELLER National Bureau of Standards 1952-1977

FORM CD-29
(2-1-52)

U.S. DEPARTMENT COMMERCE

BLANKET TRAVEL ORDER

BUREAU OR OFFICE
NATIONAL BUREAU OF STANDARDS

1. DATE OF PR ATION
November 29, 1955

2. NO. OF ORDER

3. DATE OF ORDER

4. T.R. NUMBER(s)

5. PURPOSE OF TRAVEL
To consult with the Director and other officials on programs in the fields of physics and mathematics.

6. NAME AND TITLE OF TRAVELER(s)
Dr. Edward Teller
Consultant WOC
University of California
Berkeley, California

7. ITINERARY
Berkeley, Calif. to Washington, D. C. and return as many times as necessary

8. ORGANIZATION UNIT
30.00

9. PRESENT OFFICIAL STATION
Berkeley, California

10. TOTAL ESTIMATED COST — TRAVEL $ 100.00 ** — EFFECTS $

11. APPROPRIATION AND ALLOTMENT

12. PERIOD OF TRAVEL — BEGIN ON OR ABOUT 11/29/55 — END ON OR ABOUT 6/30/56

13. FUNDS AVAILABLE (*For use of Accounts Section*)
0001

14. MODE OF TRANSPORTATION
- [X] Common carrier (*except Extra Fare train*) Via plane, train, bus
- [X] Privately-owned automobile at 10¢ per mile
  - [X] Reimbursable cost not to exceed cost by common carrier
  - [ ] Common carrier determined to be impracticable
  - [ ] Determined to be more advantageous to the Government
- [ ] Other means (*Specify*)

15. PER DIEM RATE(S)
$15.00 per diem or fraction thereof

16. CHANGE OF OFFICIAL STATION
TO

- [ ] AUTHORIZATION FOR SHIPMENT OF HOUSEHOLD EFFECTS IN ACCORDANCE WITH E.O. 9805, AS AMENDED

FROM — TO — ESTIMATED WEIGHT (*Pounds*)

- [ ] AUTHORIZATION FOR TRANSPORTATION OF ________ MEMBERS OF IMMEDIATE FAMILY IN ACCORDANCE WITH E.O. 9805, AS AMENDED

17. SPECIAL PROVISIONS OR REMARKS

** Dr. Teller plans to consult with officials of the Bureau <u>only</u> on planned trips to the East on other business, therefore charging only a portion of his travel for NBS business. For this reason the obligation of funds is as listed in Item 10 above.

If this order directs a transfer of official station, it is hereby certified that this transfer is not made primarily for the convenience or benefit of the officer or employee or at his request.

18. SIGNATURE OF APPROVING OFFICER
Original Signed by
A. V. Astin

TITLE
A. V. Astin
Director

20. DETACHED — DATE — PLACE

21. REPORTED — DATE — PLACE

22. CERTIFIED TO BE A TRUE COPY

19. CERTIFICATE OF AUTHORIZATION BY DESIGNATED AUTHORIZING OFFICER

You are hereby authorized to travel at Government expense under the conditions noted on this authorization and in accordance with the Standardized Government Travel Regulations. The number and the date of this authorization must appear on each voucher claiming reimbursement for expenses incurred consequent to this order.

Signature ____________________

Title ____________________

A8.4

☆ U. S. GOVERNMENT PRINTING OFFICE : 1952 O—987509

STANDARD FORM 50 (5 PART)
OCTOBER 1949
PROMULGATED BY
U. S. CIVIL SERVICE COMMISSION
CHAPTER R1, FEDERAL PERSONNEL MANUAL

DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

NOTIFICATION OF PERSONNEL ACTION

1. NAME (MR.—MISS—MRS.—ONE GIVEN NAME, INITIAL(S), AND SURNAME)	2. DATE OF BIRTH	3. JOURNAL OR ACTION NO.	4. DATE
Dr. Edward Teller	1-15-08	NBS 2	11-28-55 C

This is to notify you of the following action affecting your employment:

5. NATURE OF ACTION (USE STANDARD TERMINOLOGY)	6. EFFECTIVE DATE	7. CIVIL SERVICE OR OTHER LEGAL AUTHORITY
Excepted Appointment W.O.C. - Indefinite	11-28-55	Sec. 15 PL 600 and Commerce Appropriation Act

FROM		TO
	8. POSITION TITLE	Consultant
	9. SERVICE, SERIES, GRADE, SALARY	Without Compensation (F-203)
	10. ORGANIZATIONAL DESIGNATIONS	National Bureau of Standards 30. Office of the Director
	11. HEADQUARTERS	Washington, D. C.
FIELD / DEPARTMENTAL	12. FIELD OR DEPT'L	FIELD / X DEPARTMENTAL

13. VETERAN'S PREFERENCE

NONE	WWII	OTHER	5-PT.	10-POINT DISAB	10-POINT OTHER
x					

14. POSITION CLASSIFICATION ACTION

NEW	VICE	I. A.	REAL.	
	H			NUCA

15. SEX	16. RACE	17. APPROPRIATION	18. SUBJECT TO C. S. RETIREMENT ACT (YES—NO)	19. DATE OF APPOINTMENT AFFIDAVITS (ACCESSIONS ONLY)	20. LEGAL RESIDENCE
M	W	FROM: TO:	None		CLAIMED / PROVED — STATE: U.S. Citizen

21. REMARKS: This action is subject to all applicable laws, rules, and regulations and may be subject to investigation and approval by the United States Civil Service Commission. The action may be corrected or canceled if not in accordance with all requirements.

Travel authorized under Section 5 of PL 600.
Loyalty forms required under EO 10450 submitted.
Business Address: Radiation Laboratory, University of California, P.O. Box 808, Livermore, California.
Resigned from Consultant position, $50.00 per diem in the Office of the Director effective 11-27-55 cob.

George R. Porter

22. SIGNATURE OR OTHER AUTHENTICATION

ENTRANCE EFFICIENCY RATING:
Exc. #82320

EMPLOYEE'S COPY

☆ G. P. O.: 1951-935878

[Standa]rd Form No. 75
[Fe]bruary 1946

UNITED STATES CIVIL SERVICE COMMISSION

POSITION DESCRIPTION

1. Check one: Dept'l ☒ Field ☐

2. Official headquarters: Washington, D. C.

3. Reason for submission:
(a) If this position replaces another (i. e., a change of duties in an existing position), identify such position by title, allocation (service, series, grade), and position number
(b) Other (specify) New

4. Agency position No. F-203

5. C. S. C. certification No.

6. Date of certification

7. Date received from C. S. C.

8. CLASSIFICATION ACTION

ALLOCATION BY	CLASS TITLE OF POSITION	CLASS Service	Series	Grade	INITIALS	DATE
a. Civil Service Commission	Excepted Contract Position-Sec. 15, PL 600 79th Cong. & Current Commerce Approp. Act.					
b. Department, agency, or establishment	Consultant WOC	Without Compensation			/s/ CVR	3-8-55
c. Bureau						
d. Field office						
e. Recommended by initiating office						

9. Organizational title of position *(if any)*

10. Name of employee *(If vacancy, specify V-1, 2, 3, or 4)* Edward Teller

11. Department, agency, or establishment: Dept. of Commerce

a. First subdivision: National Bureau of Standards

b. Second subdivision: 30. Office of the Director

c. Third subdivision

d. Fourth subdivision

e. Fifth subdivision

12. This is a complete and accurate description of the duties and responsibilities of my position

(Signature of employee) (Date)

13. This is a complete and accurate description of the duties and responsibilities of this position

/s/ A.V.Astin (Signature of immediate supervisor) 3-4-55 (Date)

Title: Director, National Bureau of Standards

14. Certification by head of bureau, division, field office, or designated representative

(Signature) (Date)

Title:

15. Certification by department, agency, or establishment

/s/ Charles V. Ramey (Signature) 3-8-55 (Date)

Title: Classification Officer, NBS

16. Description of duties and responsibilities (See Guide to Position Classifiers, Employees, and Supervisors for the Preparation of Position Descriptions, Standard Form No. 75A)

Serves in an advisory and consultative capacity to the Director of the National Bureau of Standards on a wide variety of complex problems concerned with the Applied Mathematics and Physics programs of the Bureau.

If more space is required, use the other side and additional pages size 8 x 10½

16—47709-3 U. S. GOVERNMENT PRINTING OFFICE

STANDARD FORM 50 (5 PART)
OCTOBER 1949
PROMULGATED BY
U. S. CIVIL SERVICE COMMISSION
CHAPTER R1, FEDERAL PERSONNEL MANUAL

DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

NOTIFICATION OF PERSONNEL ACTION

1. NAME (MR.—MISS—MRS.—ONE GIVEN NAME, INITIAL(S), AND SURNAME)	2. DATE OF BIRTH	3. JOURNAL OR ACTION NO.	4. DATE
Dr. Edward Teller	1-15-08	NBS 1	11-28-55 C

This is to notify you of the following action affecting your employment:

5. NATURE OF ACTION (USE STANDARD TERMINOLOGY)	6. EFFECTIVE DATE	7. CIVIL SERVICE OR OTHER LEGAL AUTHORITY
Resignation from Excepted Appointment - When Actually Employed - Indefinite	11-27-55cob	

FROM		TO
Consultant	8. POSITION TITLE	
$50.00 per diem - WAE (F-203)	9. SERVICE, SERIES, GRADE, SALARY	
National Bureau of Standards 30. Office of the Director	10. ORGANIZATIONAL DESIGNATIONS	
Washington, D. C.	11. HEADQUARTERS	
FIELD [ ] DEPARTMENTAL [X]	12. FIELD OR DEPT'L	FIELD [ ] DEPARTMENTAL [ ]

13. VETERAN'S PREFERENCE: NONE	WWII	OTHER	5-PT.	10-POINT: DISAB	OTHER	14. POSITION CLASSIFICATION ACTION: NEW	VICE	I. A.	REAL.
X									

15. SEX	16. RACE	17. APPROPRIATION	18. SUBJECT TO C. S. RETIREMENT ACT (YES—NO)	19. DATE OF APPOINTMENT AFFIDAVITS (ACCESSIONS ONLY)	20. LEGAL RESIDENCE
M	W	FROM: TO:	FICA		[ ] CLAIMED [ ] PROVED STATE: US Citizen

21. REMARKS: This action is subject to all applicable laws, rules, and regulations and may be subject to investigation and approval by the United States Civil Service Commission. The action may be corrected or canceled if not in accordance with all requirements.

"To accept Excepted Appointment W.O.C. with National Bureau of Standards."
Forwarding Address: Radiation Laboratory, University of California
P. O. Box 808, Livermore, California

ENTRANCE EFFICIENCY RATING:

George R. Porter

22. SIGNATURE OR OTHER AUTHENTICATION

EMPLOYEE'S COPY

☆ G. P. O.: 1951-935878

Dean of Faculty

STANDARD FORM 50 (5 PART)
OCTOBER 1949
PROMULGATED BY
U. S. CIVIL SERVICE COMMISSION
CHAPTER R1, FEDERAL PERSONNEL MANUAL

DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

NOTIFICATION OF PERSONNEL ACTION

1. NAME (MR.—MISS—MRS.—ONE GIVEN NAME, INITIAL(S), AND SURNAME)
Mr. Edward Teller

2. DATE OF BIRTH
1-15-08

3. JOURNAL OR ACTION NO.
NBS 1

4. DATE
3-16-55 C

This is to notify you of the following action affecting your employment:

5. NATURE OF ACTION (USE STANDARD TERMINOLOGY)
Excepted Appointment - When Actually Employed - Indefinite

6. EFFECTIVE DATE
5-13-55

7. CIVIL SERVICE OR OTHER LEGAL AUTHORITY
5 USC 55a and Commerce Appropriation Act

FROM

TO

8. POSITION TITLE
Consultant

9. SERVICE, SERIES GRADE

NOTICE TO SEPARATED FEDERAL EMPLOYEE

(Unemployment Compensation Program)

KEEP THIS FORM. The information on this form will facilitate the determination of your rights to unemployment compensation. To file a claim for compensation, take the following items to the nearest public employment office:

1. THIS FORM (and any other such forms you have received in the past 24 months).
2. Your SOCIAL SECURITY ACCOUNT NUMBER CARD.
3. The official notice regarding your separation (Notification of Personnel Action, Standard Form 50, or other similar document).

National Bureau of Standards
Payroll Section, Accounting Division
Conn. Ave. & Van Ness St., N. W.
Washington 25, D. C.

(Federal agency will insert in box above name and address of office where employee's payroll records are maintained.)

U. S. GOVERNMENT PRINTING OFFICE 16—70927-1

ENTRANCE EFFICIENCY RATING:
Exc. #82320

George R. Porter

22. SIGNATURE OR OTHER AUTHENTICATION

EMPLOYEE'S COPY

☆ G. P. O.: 1951-935878

STANDARD FORM 50 (5 PART)
OCTOBER 1949
PROMULGATED BY
U. S. CIVIL SERVICE COMMISSION
CHAPTER R1, FEDERAL PERSONNEL MANUAL

DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

NOTIFICATION OF PERSONNEL ACTION

1. NAME (MR.—MISS—MRS.—ONE GIVEN NAME, INITIAL(S), AND SURNAME)	2. DATE OF BIRTH	3. JOURNAL OR ACTION NO.	4. DATE
Mr. Edward Teller	1-15-08	NBS 1	3-16-55 C

This is to notify you of the following action affecting your employment:

5. NATURE OF ACTION (USE STANDARD TERMINOLOGY)	6. EFFECTIVE DATE	7. CIVIL SERVICE OR OTHER LEGAL AUTHORITY
Excepted Appointment - When Actually Employed - Indefinite	5-13-55	5 USC 55a and Commerce Appropriation Act

FROM		TO
	8. POSITION TITLE	Consultant
	9. SERVICE, SERIES, GRADE, SALARY	$50.00 per diem - WAE (F-203)
	10. ORGANIZATIONAL DESIGNATIONS	National Bureau of Standards 30. Office of the Director
	11. HEADQUARTERS	Washington, D. C.
FIELD ☐ DEPARTMENTAL ☐	12. FIELD OR DEPT'L	FIELD ☐ DEPARTMENTAL ☒

13. VETERAN'S PREFERENCE

NONE	WWII	OTHER	5-PT.	10-POINT DISAB	10-POINT OTHER
X					

14. POSITION CLASSIFICATION ACTION

NEW	VICE	I. A.	REAL.	
x				NUCA

15. SEX	16. RACE	17. APPROPRIATION	18. SUBJECT TO C. S. RETIREMENT ACT (YES—NO)	19. DATE OF APPOINTMENT AFFIDAVITS (ACCESSIONS ONLY)	20. LEGAL RESIDENCE
M	W	FROM: TO:	FICA	5-13-55	☐ CLAIMED ☐ PROVED STATE: US Citizen

21. REMARKS: This action is subject to all applicable laws, rules, and regulations and may be subject to investigation and approval by the United States Civil Service Commission. The action may be corrected or canceled if not in accordance with all requirements.

Intermittent - not entitled to earn leave.
Forms required under E. O. 10450 submitted.
Travel authorized under Section 5 of P. L. 600.
Social Security Acct. No. 348-28-0765.
Business Address: Radiation Laboratory, University of California
P. O. Box 808, Livermore, California

George R. Porter

ENTRANCE EFFICIENCY RATING:
Exc. #82320

22. SIGNATURE OR OTHER AUTHENTICATION

EMPLOYEE'S COPY

☆ G. P. O.: 1951-935878

Form No. 75
...y 1946

...ITED STATES CIVIL SERVICE COMMISSION

POSITION DESCRIPTION

1. Check one: Dept'l ☐ Field ☐

2. Official headquarters

3. Reason for submission:
(a) If this position replaces another (i. e., a change of duties in an existing position), identify such position by title, allocation (service, series, grade), and position number

(b) Other (specify) **New**

4. Agency position No. F-203

5. C. S. C. certification No.

6. Date of certification

7. Date received from C. S. C.

8. CLASSIFICATION ACTION

ALLOCATION BY	CLASS TITLE OF POSITION	CLASS: Service	Series	Grade	INITIALS	DATE
a. Civil Service Commission	(Excepted "Contract" Position-Section 15 Public Law 600 79th Cong & Current Commerce Appropriation Act)					
b. Department, agency, or establishment	Consultant	$50.00 per diem				
c. Bureau						
d. Field office						
e. Recommended by initiating office						

9. Organizational title of position (*if any*)

10. Name of employee (*If vacancy, specify V-1, 2, 3, or 4*) **Edward Teller**

11. Department, agency, or establishment **Dept. of Commerce**

a. First subdivision **National Bureau of Standards**

b. Second subdivision **30. Office of the Director**

c. Third subdivision

d. Fourth subdivision

e. Fifth subdivision

12. This is a complete and accurate description of the duties and responsibilities of my position

(Signature of employee) (Date)

13. This is a complete and accurate description of the duties and responsibilities of this position

(Signature of immediate supervisor) (Date)

Title: **Director, National Bureau of Standards**

14. Certification by head of bureau, division, field office, or designated representative

(Signature) (Date)

Title:

15. Certification by department, agency, or establishment

(Signature) (Date)

Title: **For Classification Officer, NBS**

16. Description of duties and responsibilities (See Guide to Position Classifiers, Employees, and Supervisors for the Preparation of Position Descriptions, Standard Form No. 75A)

Serves in an advisory and consultative capacity to the Director of the National Bureau of Standards on a wide variety of complex problems concerned with the Applied Mathematics and Physics programs of the Bureau.

If more space is required, use the other side and additional pages size 8 x 10½ 16—47709-3 U. S. GOVERNMENT PRINTING OFFICE

cc Astin
[handwritten initials] '02

AMERICAN MATHEMATICAL SOCIETY

E. G. BEGLE
SECRETARY

YALE UNIVERSITY
NEW HAVEN 11, CONNECTICUT

January 29, 1954

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley, California

Dear Dr. Teller:

One of the recommendations of the Committee for the Evaluation of the Present Functions and Operations of the National Bureau of Standards was the creation of "area" committees as advisors to the Director of the Bureau. Dr. Astin has, therefore, asked the Policy Committee for Mathematics to appoint six members of a Technical Advisory Committee to the Applied Mathematics Division of the Bureau. The work of this Bureau is described briefly on Pages 62-68 of the Kelly Committee report and on Pages 50-52 of the Bureau's 1952 Annual Report. A copy of each of these is being sent you under separate cover.

The Policy Committee has appointed to this Technical Advisory Committee the following:

For a term of one year:

Dr. Philip M. Morse
Massachusetts Institute of Technology
Cambridge, Massachusetts

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley, California

For a term of two years:

Dr. David Blackwell
Howard University
Washington 1, D. C.

Professor A. H. Taub
Dept. of Mathematics
University of Illinois
Urbana, Illinois

For a term of three years:

Professor Mark Kac
Dept. of Mathematics
Cornell University
Ithaca, New York

Dr. Mina Rees, Dean
Hunter College
New York, New York

Yours very truly,

E. G. Begle

E. G. Begle
Secretary

EGB:ps

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO

NATIONAL BUREAU OF STANDARDS

WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.

APR 19 1954

30.10

*

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley, California

Dear Dr. Teller:

I have been informed by Professor E. G. Begle, Secretary of the American Mathematical Society, that you have agreed to serve as a technical advisor to the Director of the National Bureau of Standards, representing the American Mathematical Society. This is most welcome news and I am indeed pleased at the prospect of having the benefit of your experience and judgment in planning and guiding the technical work of the National Bureau of Standards.

Each of the major scientific societies concerned with the activities of the National Bureau of Standards has appointed representatives to serve similarly as advisors and we are now acting to form the "area" technical advisory committees recommended in the report of the Ad Hoc Committee for the Evaluation of the Present Functions and Operations of the National Bureau of Standards. A copy of this report should, by this time, be in your hands. If you have not received one please let me know so that one can be supplied.

As a first step we are calling together the AMS representatives for a preliminary meeting to discuss procedures for making optimum use of the services of the advisors. The time of the meeting is tentatively set at 9:30 A.M. in Room 301 South Building, National Bureau of Standards, Monday May 10th. I would appreciate a reply indicating whether or not it will be possible for you to attend this meeting. If it is not possible, please indicate alternate dates and we will attempt to select a more suitable time and write you again.

It is planned to reimburse the advisors for transportation costs and for incidental subsistence expenses, the latter by a per diem allowance of $10.00. It is my understanding that most of the advisors prefer to serve without compensation for personal services. Expense allowances for this particular trip are established on this basis.

MR:hch
cc: Dr. Huntoon

Mina Rees
Mina Rees
Dean of Faculty

This letter will serve as your authorization to incur travel expense for the trip from your residence to Washington and return should you care to use it.

All of our senior staff are looking forward with great enthusiasm to the opportunity of consultation with these eminent scientific advisors about their programs and plans. I wish to extend for them our sincere appreciation of your willingness to take time from your many duties to assist us.

Sincerely yours,

A. V. Astin
Director

MR:hch
cc: Dr. Huntoon

Mina Rees
Mina Rees
Dean of Faculty

HUNTER COLLEGE
OF THE CITY OF NEW YORK
695 PARK AVENUE
NEW YORK 21, N. Y.

Office of the Dean of Faculty

November 10, 1954

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley, California

Dear Dr. Teller:

At the conclusion of the meeting of the Technical Advisory Committee for Mathematics (NBS) on October 23, it was agreed that the members of the Committee would undertake to acquaint themselves in detail, through visits to the appropriate sections of Division 11, with the program and procedures of the Mathematics Division of the Bureau. I am writing to you now to ask whether you can arrange to inform yourself fully about the activities of the Mathematical Physics Section, as well as the New Computater Division (Name?) before February 1, 1955. I am directing this kind of request to each member of the Committee in the hope that we can have a meeting of the Committee in February at which we will be rather fully informed about the whole picture.

Because the morale situation in the Mathematics Division is not optimum, it would be helpful if you would advise Dr. Huntoon of the time you plan to visit and arrange to discuss with him before your visit certain questions which it would be well for you to know about.

At the next meeting of the Technical Advisory Committee we hope to have a detailed report from the senior members of the Division about the ways in which a really modern machine would be helpful inside the Bureau. In particular, we have asked the Acting Chief of the Division to consult with other Bureau Divisions including those that have not been using the services of the Mathematics Division concerning possible aid which they might receive if the Division were equipped with a fully modern machine as well as with excellent personnel.

Thus I hope that it will be possible at a meeting in February to see our problem in perspective with an intimate understanding of internal Division problems and with a clearer concept of the role which the Division may play in the total Bureau picture.

If we can achieve this understanding we expect to approach other Advisory Committees in an attempt to secure closer cooperation in appropriate places.

I shall welcome your comments on any of the questions that I have raised here, or on the overall problems presented by the Advisory Committee assignment.

Yours sincerely,
Mina Rees
Mina Rees
Dean of Faculty

MR:hch
cc: Dr. Huntoon

AIR MAIL SPECIAL DELIVERY

November 11, 1955

Dr. R. D. Huntoon
Associate Director for Physics
U.S. Department of Commerce
National Bureau of Standards
Washington 25, D.C.

Dear Dr. Huntoon:

After mailing an earlier confirmation letter to you today, some urgent matters have arisen which require Dr. Teller to cancel his scheduled eastern trip.

Unfortunately, he will not be able to keep his appointment with you for the afternoon of November 22nd. He will, however, plan to come to Washington again in the near future, and when dates firm up, we will contact you again.

Dr. Teller was looking forward to spending some time with you, and regrets he can't make the trip at this time.

Sincerely yours,

(Mrs.) Joan Jaffray
Secretary to Edward Teller

Nat'l B. Stand. file

see trip 12/11/55 – 12/23/55

November 11, 1955

Dr. R. D. Huntoon
Associate Director for Physics
U.S. Department of Commerce
National Bureau of Standards
Washington 25, D.C.

Dear Dr. Huntoon:

Conforming our conversation this morning, Edward Teller plans to spend the afternoon of November 22nd (Tuesday) in consultation with you.

I will ask him to telephone you if he can make it for lunch that day; however, he has a morning meeting and may not be free in time.

Thanks for your assistance in the matter of Dr. Teller's expenses.

Sincerely yours,

(Mrs.) Joan Jaffray
Secretary to Edward Teller

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

Phone
Emerson - 2 4040

IN YOUR REPLY
REFER TO FILE NO.
30.20
260-55

October 10, 1955

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley 4, California

Dear Dr. Teller:

Thank you for your letter of October 5 in which you indicate you can be available for consultation about the middle of November. This time will be satisfactory.

As indicated in my previous letter, I think you should plan for half a day to discuss the math computer and associated problems. If you can arrange to spend a full day with us, there are others who would appreciate a chance to consult with you about some of our other physics problems.

Please let me know the specific date as soon as you can so I can arrange the schedule here. At the same time it will be helpful to know if you will be able to spend the full day so I can arrange the rest of the schedule.

We look forward to seeing you in November.

Sincerely yours,

R. D. Huntoon

R. D. Huntoon
Associate Director for Physics

Tuesday PM

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.
30.20
243-55

September 21, 1955

Dr. Edward Teller
Radiation Laboratory
University of California
P.O. Box 808
Livermore, California

Dear Dr. Teller:

I have recently learned that you plan to be in the east during the period October 10-22.

I hope that you will be able to arrange some time during this period to come to the Bureau for about a half-day consultation. We wish to review with you the status of plans and activities for the math computer and get your advice about further steps that might be feasible to take.

If you can find it convenient to let me know some time in advance when you can come to the Bureau, I will take the necessary steps to fit our people's schedule in with yours. We will look forward with interest and enthusiasm to seeing you in October.

Sincerely yours,

R. D. Huntoon
Associate Director for Physics

May 6, 1955

Dr. R. D. Huntoon
National Bureau of Standards
Washington 25, D. C.

Dear Dr. Huntoon:

Dr. Teller is arriving in Washington for some Air Force meetings on the morning of May 11. He will have to attend the meetings through the 12th, and has some business at the AEC on the 13th. I have reminded him, on his itinerary, to look you up while he is there, but in case you wish to get in touch with him, he will be at the Statler on the 11th and 12th. He leaves for New York on the evening of the 13th.

I hope there will be an opportunity for you to see Dr. Teller on this visit to get some of the details of his consultancy worked out.

Sincerely yours,

(Mrs.) Ruth P. Brockett
Secretary to Edward Teller

April 4, 1955

from S. N. Alexander
Data Processing Systems Div.
Nat'l. Bu[reau of] Stds.

aboard UNITED AIR LINES DC-7

Dear Prof. Teller:

During the course of the first Math. Advisory Group to N.B.S. you expressed an interest in the high performance digital computer our division had planned for the Air Forces Comptroller. I recall that you took away an advance copy of report #3627. Because you made an early departure from the meeting I did not get the opportunity to tell you that this report contains the thinking of at least 12 to 18 months ago, simply recorded for the project termination purposes. Our thinking and planning had gone well beyond that stage at the time you obtained report #3627.

I felt that after you had an opportunity to peruse this material the additions and improvement would be present in proper context. For this reason I looked forward to seeing you at the next Math Advisory Group session. Bob Huntoon notified me just before that session that you could not continue to serve, but would remain as a special

The Continental

aboard UNITED AIR LINES DC-7

N.B.S. advisor. I would hope that you plan to come East for the Physical Society meeting in Washington at the end of April. We would be very interested in having you hear the plans and proposed characteristics for a modern machine that is being evolved. The Math Advisory Group recommend that N.B.S. develop a plan for a machine suited to its long term needs in support of its physical science program. This has accelerated the activity considerably and some attractive innovations have been proposed. If we a able to crystallize the efforts to-date in time for a formal progress report, there will be a meeting of the Advisory Group during the Physical Society meetings in Washington.

Even if this formal presentation is not scheduled, we certainly would be most happy to have an informal get-together with you and any interested parties that you may desired to invite. I have had informal discussion with the RAND staff and they are thinking about the future tend, now that their IAS-type machine is

The Continental

aboard UNITED AIR LINES DC-7

fitted with the ferrite-core fast memory. I got the RAND views on the proposal for a large capacity machine advanced by Louie Ridenour's group. We feel that the "expandable-nucleus" machine structure, which is at the core of both plans, is capable of fuller development. Also we feel that arithmetic-power of the NORC level can now be attained with modest amounts of equipment and in a compact, low power form. (Example: Add-type operations in 4 micro-seconds for 52 bits) Also provisions for adequate treatment of large matrix manipulations and eigenvalue determinations seem to indicate that a more effective plan for the input-output system need to be incorporated --- and this too should be expandable over a wide range.

I hope these sketchy comments will aid in your evaluation of this proposed get-together. If another time will be more convenient I'm certain we can arrange for it. This point in time seems like a good one for mutual exchange on concepts and objectives for this next round of development. Perhaps there may even be the basis for another mutual technical-assistance effort similar to the one that grew around the I.A.S. machine. Let me hear from you or inform Bob Huntoon directly.

The Continental

Sam Alexander

P.S. Excuse the informal correspondence.

December 2, 1954

Mr. C. N. Coates
315 South Building
National Bureau of Standards
Washington 25, D.C.

Dear Mr. Coates:

I am enclosing the travel and expense statement for Dr. Teller's Technical Advisory Panel meeting of October 23. I am sorry there has been such a delay, but as you will see, the itinerary was rather involved, and it has taken me some time to get it broken down and the portions assigned in what seems to be an equable manner.

Dr. Teller did not use the TR's, and it probably will be simpler not to use them on future trips. He did travel tax exempt, however.

I hope I have filled in the form sufficiently for your purposes, and if there are any doubts or questions, I shall be glad to try to get them resolved.

Sincerely yours,

(Mrs.) Ruth P. Brockett
Secretary to Edward Teller

Enclosures:- Travel statement
TR book 21087
RR stubs
Taxi receipts
Hotel receipt

NATIONAL BUREAU OF STANDARDS

TRAVEL INSTRUCTIONS FOR CONSULTANTS

It is the desire of the National Bureau of Standards to authorize travel by its consultants in the most convenient manner consistent with Standard Government Travel Regulations. The following information has been assembled to acquaint you with the proper use of Government Transportation Requests and to apprise you of the most frequently misunderstood limitations on government travel.

1. The enclosed copy of your travel authorization specifies the points between which travel may be performed at Government expense. It permits travel by train, plane or private automobile. You may select the most convenient mode of transportation for your trip. In the case of travel by private automobile, however, you will be reimbursed at the mileage rate specified only to the extent that such expenses do not exceed the cost of a direct trip by common carrier.

2. It is the responsibility of the traveler to accomplish his trip by the most direct and usually traveled route. If, for personal convenience, you find it necessary to travel by an indirect route, we will be unable to reimburse you for expenses beyond those that would have been incurred by a usually traveled route. (See paragraph 9)

3. It is also the responsibility of the traveler to take advantage of round trip rates whenever possible. For this reason, you should normally plan to utilize the same mode of transportation (I.E. plane or train) both to and from the Bureau. If, however, your time schedule is such that mixed modes of transportation must be utilized to make your visit to NBS feasible, kindly explain this fact when submitting the statement of your travel, and reimbursement to the fullest extent legally possible will be made.

4. When ready to travel, purchase a ticket (round trip if at all feasible) at the local airline or railroad ticket office, and issue a Government Transportation Request (T/R) in payment. T/R's can be issued only to common carriers, not to travel agencies.

5. The green copy of the T/R filled out and signed by you, the traveler, is detached and given to the Ticket Agent in payment of the fare. The white carbon copy is retained in the book for submission with your travel statement when the trip is completed (see paragraph 16). All information which appears on the green copy should be embodied on the white, including the cost of the tickets.

6. Print your name on the "For use of" line on the T/R. You need make no entry in the "Appropriation" or "Authorization or object" blocks. Other information required on the T/R is believed to be self explanatory. Most Ticket agents are familiar with this form and can assist you should questions arise.

7. Government travel regulations permit the use of the lowest first class accommodations available on common carriers. When traveling by train, this means

..e seat in a sleeping or parlor car for a continuous trip of two or more hours duration, or a standard lower berth if night travel is involved. Should no lower berth be available, the lowest cost superior accommodation available may be substituted. It will be necessary to issue separate T/R's in payment for Pullman accommodations.

8. Extra fare trains or planes are not authorized. Should you desire to use such service at your own expense, you should issue a T/R for the standard fare and pay in cash to the common carrier for the additional cost of the special service. Similarly, use of roomettes, compartments or other superior accomodations can not be authorized (except as noted in paragraph 7) and additional costs should be paid in cash if you elect to use them at your own expense.

9. If indirect travel routes are used for personal convenience, issue T/R's for the usually traveled direct route and pay in cash for the additional cost of the indirect route ticket obtained. The route taken should be indicated in the space provided on the reverse of the T/R.

10. Do not issue a T/R in payment of transportation charges of less than $1.00. Pay in cash and request reimbursement when submitting your travel statement.

11. Fees for excess baggage should not be paid by T/R's. If essential to your business at NBS, claim reimbursement for such fees and submit receipts with your travel statement.

12. Travel regulations allow reimbursement for taxi fare only in the following instances:

a. From residence to station.
b. From station to place of business or hotel (but not both).
c. From place of business or hotel to station.
d. From station back to residence.

13. Reimbursement may be requested for telegrams or telephone calls pertaining to NBS business. Requests for room reservations and notifications of safe arrival must be considered personal business, however.

14. A per diem allowance in lieu of subsistance expenses will be paid at the rate specified in your travel authorization during the time that you are traveling in behalf of the Bureau. Should your trip be prolonged for personal convenience, please indicate clearly in your travel statement those hours devoted to personal business.

15. It is suggested that you keep a record of the dates and actual times (hour) of train or plane departure and arrival since this information will be needed for preparation of a reimbursement voucher.

16. Upon completion of travel, please submit to the office indicated below, a statement of travel similar to the attached form. Enclose the white carbon copies of T/R's issued, and explain the need for indirect routing, mixed modes of transportation, or superior accommodations which may have been utilized (see paragraphs 2,3 & 7). From this information, a reimbursement voucher will be prepared by the Bureau for your signature and then submitted for payment

17. Please report promptly the loss or theft of T/R's.

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

Emerson 2-4040
7-688

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.
30.10
26-54

*

September 16, 1954

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley, California

Dear Dr. Teller:

Professor Philip Morse of the NBS Technical Advisory Committee for Mathematics suggested November 12 as a possible date to hold a meeting of this group. He has requested that I proceed with preliminary arrangements.

I would appreciate knowing as soon as possible whether or not this date is convenient for you.

Sincerely yours,

R. D. Huntoon /ff

R. D. Huntoon
Associate Director for Physics

cc: Prof. Morse
Mr. Coates

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.

*

Professor Edward Teller
Radiation Laboratory
University of California
Livermore, California

Dear Ed:

Because David Blackwell and Ed Condon (the new member of our NBS - TAC) will not be able to attend a meeting for several months if we do not hold it immediately, I have decided to go ahead with a February 3 meeting. I am very sorry you cannot attend; but I do hope you will be able to be present at a later meeting which I suspect we shall have to hold for a further discussion of the study the Mathematics Division has been making of its relation to the rest of the Bureau.

As your formal association with our Committee is terminated, I want to tell you how extremely valuable I have found your participation in our work, and how significant I believe your contribution has been toward our effort to improve the effectiveness of the Mathematics Division. Though I regret that you will not continue as a member of the Committee, I hope we may count on you for informal assistance.

Yours sincerely,

Mina Rees

Mina Rees
Chairman
Technical Advisory Committee for Mathematics

January 27, 1955

Mr. Sinclair Weeks, Secretary
Department of Commerce
Washington 25, D. C.

Dear Mr. Weeks:

Thank you very much for your letter of January 18th. It was a great disappointment to me not to be free to accept your kind invitation to attend the open house of the Bureau on February 7 and 8. As my secretary told Dr. Astin's secretary, there are meetings in Berkeley beginning on February 7, to which I have been committed for quite a long time, and it is therefore impossible for me to get away.

The new facilities sound very nice and most worth while. I do hope that the next time I am in Washington I may be permitted to visit the laboratories and learn something more about them. As you may be aware, I have had, for a number of years, a deep interest in the activities of the Bureau, and always appreciate an opportunity to visit there.

Please accept my sincere regrets that I am not able to visit the Bureau upon this occasion, and thank you again for your courtesy in inviting me.

Sincerely yours,

Edward Teller

THE SECRETARY OF COMMERCE
WASHINGTON 25

January 18, 1955

Dr. Edward Teller
Radiation Laboratory
University of California
P. O. Box 808
Livermore, California

YOUR REPLY
TO FILE NO
.20
-55

Dear Dr. Teller:

Two important new facilities have recently been put into operation at the National Bureau of Standards. These are a gamma ray laboratory for the standardization of radioactive materials and an addition to the Betatron Laboratory for the development of standard measuring techniques for very high energy X-rays. The activities in each of these facilities have an important bearing on advances in the utilization of atomic energy and its by-products in medicine, industry and research.

In connection with the first public showing of these facilities, the Bureau is holding an open house on February 7th and 8th. I would like very much to have you visit the Bureau at that time. In order to provide some flexibility for the guests of the open house, three showings have been set: At 8:00 p.m. on Monday, February 7, and at 3:00 p.m. and 8:00 p.m. on Tuesday, February 8. The general program will feature the relationship between the Bureau's activities and our technological economy, with illustrations from a variety of fields of science and engineering. The open house program will start with a demonstration in the Bureau's High Voltage Laboratory, located on Van Ness Street between Connecticut Avenue and Reno Road. Immediately following the demonstration, other research laboratories will be open for inspection.

I sincerely hope that you will be able to attend and would appreciate a call from your secretary to the office of the Director, National Bureau of Standards, as to whether we may expect you, and which showing you prefer. Dr. Astin's telephone number is EMerson 2-4040, or code 154, extension 7411.

Sincerely yours,

Sinclair Weeks
Secretary of Commerce

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.

30.20
18-55

*

January 21, 1955

Dr. Edward Teller
Radiation Laboratory
University of California
P.O. Box 808
Livermore, Calif.

Dear Dr. Teller:

In view of the response to our invitation to schedule a meeting of the PCM Technical Advisory Committee to the National Bureau of Standards, it has been determined that February 3 is the most suitable date. Therefore, arrangements have been made to hold this meeting at 9:30 A.M., February 3 in Room 301 South Building of the National Bureau of Standards.

Dean Rees has suggested that the agenda include an oral report by those members of the committee who have visited sections of the Bureau since the meeting of October 23, 1954.

We look forward to seeing you on the 3rd.

Sincerely yours,

R. D. Huntoon

R. D. Huntoon
Associate Director for Physics

January 18, 1955

Dr. R. D. Huntoon
Associate Director for Physics
National Bureau of Standards
Washington 25, D. C.

Dear Dr. Huntoon:

Thank you for your letter of January the 11th. I am sorry, but I can not attend a meeting of the PCM-NBS Technical Advisory Committee on February 3, because if I am able to get away at all, I have a prior commitment in Oak Ridge. Unfortunately, at present, uncertainties in my plans-both personal and professional-do not permit me to suggest an alternative date.

Please convey my regrets to Dean Rees. I appreciate her kindness in inviting me to attend the meeting. Perhaps if the date could be moved to early in March, I might be free at that time to get away, and I certainly should be much interested in participating in such a meeting. However, at the moment, I am just not able to make any specific commitments other than definitely to say I could not be there on February 3.

Sincerely,

Edward Teller

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.
30.20
8-55

*

January 11, 1955

Dr. Edward Teller
Radiation Laboratory
University of California
P.O. Box 808
Livermore, California

Dear Dr. Teller:

Dean Mina Rees, Chairman of the PCM-NBS Technical Advisory Committee wishes to call a meeting of the committee to be held at the National Bureau of Standards on Thursday February 3 at 9:30 A.M. Room 301 South Building. Please indicate promptly if this date is satisfactory.

There seem to be no possible alternative dates prior to the last week in February. If you cannot arrange to attend on February 3 please indicate suitable alternative dates in late February or early March.

You will be notified as soon as possible when the date is settled.

Although your term of service on the committee has expired, Dean Rees would appreciate your attendance at this meeting to give you an opportunity to summarize your views for the rest of the committee and to collaborate in forming recommendations to the Director of NBS. I hope you will be able to be present so that we can properly express our appreciation for your helpful and stimulating advice on the program and operations of the applied mathematics program.

Sincerely yours,

R. D. Huntoon

R. D. Huntoon
Associate Director for Physics

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

October 7, 1954

IN YOUR REPLY
REFER TO FILE NO.

*

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley, California

Dear Dr. Teller:

I have been advised by Dr. R. D. Huntoon that the National Bureau of Standards Technical Advisory Committee from the Policy Committee for Mathematics plans to meet on October 23, 1954.

Since you were unable to attend the initial meeting of this group on May 10, 1954, we have had no occasion to determine whether you may wish to travel at Government expense when attending these meetings. The Bureau is prepared to reimburse its Advisors for traveling expenses insofar as possible under Government travel regulations, and has provided several members of your Committee with Government Transportation Requests for this purpose.

Since there is little time for an exchange of correspondence before the October 23, meeting, I am enclosing a book of transportation requests which may be used to attend this and other meetings of the Committee should you care to use them. The Travel Instructions which also are enclosed explain the manner in which these requests should be used. You may notice that the travel authorization mentioned in the instructions is not enclosed. This will not interfere with your use of the transportation requests. A suitable authorization will be on file in this office.

The requests may be retained for possible future use even though not needed for the forthcoming meeting. If, however, you do not wish to be reimbursed for any traveling expense connected with your Committee's activities in behalf of the Bureau, please return the enclosed material to this office.

I hope that you find it possible to be with us on October 23, and look forward to the pleasure of meeting you at that time.

Very truly yours,

C. N. Coates
C. N. Coates
Administrative Secretary
NBS Technical Advisory Committees

Enclosures

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

October 22, 1953

IN YOUR REPLY
REFER TO FILE NO.

11.0

Dr. Edward Teller
Radiation Laboratory
University of California, Box 808
Livermore, California

Dear Dr. Teller:

You are cordially invited to attend the next meeting of the Applied Mathematics Advisory Council, which will convene on Friday, November 13, 1953, at 10:00 a.m. in the South Building Conference Room of the National Bureau of Standards, Connecticut Avenue and Van Ness Sts., N. W., Washington, D. C.

Very truly yours,

Franz L Alt

Franz L. Alt, Acting Secretary
Applied Mathematics Advisory Council.

September 24, 1953

Dr. Raymond J. Seeger
National Science Foundation
2144 California Street, N. W.
Washington 25, D. C.

Dear Raymond,

Please excuse the formality of the enclosed letter, but I thought such a letter should probably be formal. One of my principal reasons for regret at resigning from the Council is, of course, that I had looked forward to being on this panel with you. It is indeed a great disappointment not to be able to continue this enterprise, but I hope very much that frequent occasions will arise when we may renew our associations and talk over many things together.

With best regards,

Edward Teller

Enclosure

September 24, 1953

Resign

Dr. Raymond J. Seeger, Chairman
Applied Mathematics Advisory Council
c/o National Science Foundation
2144 California Street, N. W.
Washington 25, D. C.

Dear Dr. Seeger:

Because of a very heavy schedule, occasioned by my having joined the Faculty of the University of California at Berkeley, in addition to my duties at Livermore, I shall have, regretfully, to resign from the Applied Mathematics Advisory Council. As you are perhaps aware, I have in the past encountered some difficulty in attending the meetings of the Council regularly, and with my return to teaching this year, it seems wisest that I keep my outside commitments to a minimum.

It has been a great pleasure to be associated with the group for the past two years, and my decision to resign is not at all based on a lack of interest in the activities of the Council but derives completely from the fact that I shall just not have the time to attend the meetings. If, in the future, I may render a service to the Council in any other way, I shall be very happy to do so.

Sincerely,

Edward Teller

Dr Teller

Minutes of the Executive Session
Applied Mathematics Advisory Council

May 12, 1953

Resign

In attendance:

M. Abramowitz	T. J. Killian
F. L. Alt	E. P. Little
A. V. Astin	D. H. Lehmer
D. Blackwell	P. M. Morse
E. W. Cannon	Mina S. Rees
C. Eisenhart	J. B. Rosser
O. G. Haywood	J. H. Roberts
A. D. Hestenes	R. J. Seeger
M. R. Hestenes	C.V.L. Smith
I. Hershner	J. J. Stoker
H. D. Huskey	A. H. Taub
W. Jacobs	J. Todd
C. Kaplan	Olga T. Todd

1. Dr. Philip Morse, Chairman of the Committee on Mathematical Tables and Research Computing, reported for that Committee. He recommends that the next action be the calling of a conference or a series of conferences on mathematical tables, and that this action be delayed until the next Council meeting.

2. Dr. Morse reported for the Committee charged with drafting a letter of commendation for Dr. John Curtiss. The letter was unanimously approved and dispatched to Dr. Curtiss. A copy of the letter is attached.

3. Dr. J. Barkley Rosser, Chairman of the Ad Hoc Committee constituted to "review the program of NAML with particular emphasis upon the future of INA, and to advise the directorate of NBS as to the appointment of a permanent Division Head", reported for his Committee. The Chairman read a telegram from Dr. Astin to Dr. Lehmer, dispatched on April 15, 1953 after the first meeting of the Committee. Dr. Rosser stated that emergency action on INA seemed less urgent now than at the time of the Council meeting on April 3, since no changes in the status of INA were likely to be made before the report of the Kelly Committee. The problem of INA boiled down to a choice between continuing the Institute in its present setup in the Bureau, or changing over in whole or part to UCLA. There were so many pros and cons and so many difficulties in either alternative that the Committee was not ready to make a recommendation. The Committee considers it questionable whether computing services should be continued to the same extent as in the past, and especially whether the rental of IBM machinery for computing services should be continued.

After considerable discussion the following resolution formulated and approved unanimously.

> "The primary mission of the INA should be research in numerical analysis. The staff and facilities necessary to support this activity should be kept at UCLA. The Ad Hoc Committee should continue to study the Government relationships and financing deemed most appropriate for future operations, with primary recognition of the need for stability in research organizations."

4. Colonel Haywood moved that the earlier recommendation of the Committee "that the Bureau purchase the best computer which will be available within the next two years" be held in abeyance pending clarification of the future mission of the Bureau. The motion was unanimously approved.

5. A Committee was appointed to draft a resolution thanking Dr. Lehmer for his valuable services at INA. The Committee consists of Dr. Taub as Chairman, Dr. Rees, Dr. Blackwell, and Major Hershner.

F L Alt

F. L. Alt, Acting Secretary
Applied Mathematics Advisory Council

Attachment

COPY

May 12, 1953

Dr. J. H. Curtiss
University Faculty Club
Harvard University
Cambridge, Massachusetts

Dear Dr. Curtiss:

The Applied Mathematics Advisory Council wishes both to congratulate you for your achievements in planning, organizing and administering the National Applied Mathematics Laboratory and to express our regret that you have decided to relinquish the directorship. In the seven years you have been with the National Bureau of Standards its activities in the fields of numerical analysis, high speed computation and statistical analysis have expanded manyfold and, under your guidance and inspiration, have attained high scientific repute, both national and international. In our opinion the administration of the National Applied Mathematics Laboratory, its procedures for dissemination of the results of its work and its arrangements for cooperative research with universities and other agencies, all of which you have organized, have set valuable precedents for research management in government agencies.

The members of the Advisory Council desire to express their appreciation of many pleasant personal contacts with you, which we hope will continue, and wish you joy and success in your next task.

Sincerely yours,

Raymond J. Seeger, Chairman
Applied Mathematics Advisory Council

cc: Director, NBS
Personnel

RJS/elt
Copy

April 16, 1953

M E M O R A N D U M

TO : Dr. Edward Teller

FROM : Raymond J. Seeger, Chairman
Applied Mathematics Advisory Council

SUBJECT: AMAC Meeting

This is to advise that the next Applied Mathematics Advisory Council meeting will be held at the National Bureau of Standards on Tuesday, May 12, 1953 in the South Conference Room (301 South).

Please send items for the agenda directly to me at the National Science Foundation, 2144 California St., N.W. on or before April 27. A detailed agenda and minutes of the last meeting will be sent from NBS on May 1, 1953.

Raymond J Seeger
Raymond J. Seeger

May 6, 1953

Dr. Raymond J. Seeger
National Science Foundation
Washington 25, D. C.

Dear Raymond:

Thank you for the invitation to the meeting of the Applied Mathematics Advisory Council. I find that it is impossible for me to be in Washington on May the 12th, which is the day mentioned in your letter. I shall, however, be in Washington on the 14th and 15th. I expect to stay at the Roger Smith and I will try to get in touch with you.

I expect that the Applied Mathematics Advisory Council will want to consider in its meeting the future of the computing program at the Bureau of Standards and I am very unhappy that I have to miss this particular meeting. I understand that there is a possibility of tying up a sizable portion of the program in some arrangement with the University of California at Los Angeles. I think that this might be a good idea and I wonder whether I could help in any way in making arrangements with UCLA, where I have some friends.

Our group in Livermore is very much interested in getting additional theoretical help within the next few months. I suppose that in your present work with the National Science Foundation you are in touch with good young people and you might be able to give me a lead in recruiting.

Looking forward to talking to you in Washington about all these things,

With best regards,

Edward Teller

May 8, 1953

Mr. L. O. Rodriguez
National Bureau of Standards
Department of Commerce
Washington 25, D. C.

Dear Mr. Rodriguez:

Dr. Teller will unfortunately be unable to attend the next meeting of the AMAC on May 12, 1953 in Washington, D. C. I am therefore returning the travel orders and the Government Requests for Transportation.

Very truly yours,

Ruth P. Brockett
Secretary to Edward Teller

Encls. Travel orders
Transportation Req. Bk. 20770

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

5 May 1953

IN YOUR REPLY
REFER TO FILE NO.
11.0

*

Dr. Edward Teller
P. O. Box 808
Livermore, Calif.

Dear Dr. Teller:

This is in further reference to our letter of 1 May 1953, informing you that the next meeting of the Applied Mathematics Advisory Council will be held in the South Building Conference Room on Tuesday, 12 May 1953, at 10:00 A.M.

We are enclosing a copy of your travel orders and a book of Government Requests for Transportation so that you may purchase the necessary transportation to attend the meeting. In the event you cannot attend, please return the book using the enclosed envelope which requires no postage.

In order to facilitate the entrance on duty of all scientific advisors, we have asked a representative from our Personnel Division to come to our office about 9:00 A.M. Please report upon your arrival at the Bureau to Room 415 South Building to execute these papers so that you may be paid for your services.

If I can be of further assistance to you, please let me know.

Very truly yours,

L. O. Rodriguez
Administrative Officer
National Applied Mathematics Laboratories

Enclosures

Minutes of the Executive Session
Applied Mathematics Advisory Council

January 16, 1953

In attendance:

Mr. Morton Alpern
Dr. J. H. Curtiss
Mr. N. E. Golovin
Major I. R. Hershner, Jr.
Dr. E. P. Little
Dr. William Mersman
Dr. Mina Rees
Dr. J. H. Roberts
Dr. R. J. Seeger
Dr. J. J. Stoker
Dr. A. H. Taub
Dr. Edward Teller

1. There was an extended discussion with Mr. William Bell of Telecomputing Corporation concerning his paper and the remarks which were made afterwards. Mr. Bell was present at this discussion. It was finally decided that the Council will watch closely the situation pointed out by Mr. Bell for one year but will take no immediate further action.

2. A report was made on the finances of the NAML. This is the usual quarterly status report required by the Charter. Dr. Curtiss reported that the financial picture was generally satisfactory, and that in particular the large deficit that had been noted at the beginning of the year at the INA's Mathematical Services Unit had been made up at a rate which promises a surplus by the end of the year.

3. Russian Translations. Certain members of the Council felt that this activity should not be over emphasized at the expense of original research and exposition. Mr. Golovin pointed out that translation activity being in a category of a library matter, could properly be charged to the INA overhead. Dr. Seeger pointed out that the National Science Foundation has a question of translation under active consideration at the present moment, and is expected to come out with a solution to the problem of coordination and advise on the selection of translations in a short period of time.

4. The Chairman opened the matter of setting up a sub-committee to help the Director of the NBS to get a larger appropriation for mathematics. There was extensive discussion of this in the course of which Dr. Curtiss pointed out that although it might be desirable to accept the present two-million dollar budget as a ceiling (as representing an optimum size for the organization in view of the other activities of the NBS competing for budget and space) nevertheless it would be desirable to replace the many small problem solving activities of the NAML,

performed on a reimbursable basis, by subsidized larger, more difficult, more challenging projects. It was however pointed out that this was something of a reorientation of the entire program and required further study by the Council. The final conclusion reached in this discussion was that Dr. Seeger would discuss the matter of using the AMAC to help the Director of the NBS to get a better appropriation for mathematics.

5. Dr. Little announced that the OARAC had passed acceptance tests on 5 January 1953 and was now being shipped to Wright Field.

6. The secretary was requested to try to get the minutes of the AMAC meeting out one month after each meeting, and to collect suggestions for the next meeting one month before the meeting.

J. H. Curtiss

J. H. Curtiss, Secretary
Applied Mathematics Advisory Council

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

25 March 1953

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY*
REFER TO FILE NO.
11.0

*

Dr. Edward Teller
Post Office Box 808
Livermore, California

Dear Dr. Teller:

We are pleased to forward to you Treasurer Check #19,739,987 for $9.00. This check covers reimbursement for per diem in connection with your trip to the Applied Mathematics Advisory Council.

Very truly yours,

L O Rodriguez

L. O. Rodriguez
Administrative Officer
National Applied Mathematics Laboratories

Enclosure (1)

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
NATIONAL APPLIED MATHEMATICS LABORATORIES

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR NUMERICAL ANALYSIS
UNIVERSITY OF CALIFORNIA
405 HILGARD AVENUE
LOS ANGELES 24, CALIF.

IN YOUR REPLY
REFER TO FILE NO.

February 13, 1953

Mrs. Ruth P. Brockett
Radiation Laboratory
University of California
Berkeley, California

Dear Mrs. Brockett:

Enclosed is a new travel voucher which has been prepared for Dr. Teller covering per diem claim for January 16. If the voucher and trip report are in order now, please have Dr. Teller sign as indi… riguez in our Washington Offi…

… to our Washington Offi… be issued.

… ince they are Dr. Tell… nployed" takes care of t…

… ich has delayed paym… take care of the situ…

… y truly yours,

Evelyn Michaud

… Evelyn Michaud,
… inistrative Officer

Encl…

INSTRUCTIONS
FOR HANDLING DEPOSIT BY MAIL ITEMS

You will find it exceedingly easy if you use this special Deposit Ticket provided for your convenience and follow these simple instructions:

1. Fill out the attached deposit ticket in the usual manner. Write your name at the top exactly as your account is carried on our books.
2. Endorse checks in this way:

Pay to the order of
Bank of America
NATIONAL TRUST AND SAVINGS ASSOCIATION
Your signature, as check is drawn, followed if necessary, by your correct signature.

3. Enclose checks, etc., in envelope provided.
4. SEND CURRENCY BY REGISTERED MAIL.
5. Fill in mailing address on reverse side. The acknowledgment will be returned to you together with a new deposit ticket and envelope.

It is not necessary to send your pass book each time a deposit is made.

IN-M-123 1-52

DEPOSITOR:

If you desire us to acknowledge this deposit, please write or print your name and address clearly on the lines to the right.

DO NOT USE THIS SPACE:

AMOUNT $ 9.00

We credit the above amount to the the

COMMERCIAL ACCOUNT ☐

SAVINGS ACCOUNT ☐

No. ____________

TENPLAN ACCOUNT ☐

____________ ☐

in the name shown on the deposit ticket received with this advice.

Bank of America
NATIONAL TRUST AND SAVINGS ASSOCIATION

By N

DANVILLE BRANCH
DANVILLE, CALIF. 225
Branch

225 MAR 31 '53
Date

NAME Dr. Edward Teller

ADDRESS P.O. Box 808

CITY Livermore, Calif

ZONE

STATE

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
NATIONAL APPLIED MATHEMATICS LABORATORIES

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR NUMERICAL ANALYSIS
UNIVERSITY OF CALIFORNIA
405 HILGARD AVENUE
LOS ANGELES 24, CALIF.

IN YOUR REPLY
REFER TO FILE NO.

February 13, 1953

Mrs. Ruth P. Brockett
Radiation Laboratory
University of California
Berkeley, California

Dear Mrs. Brockett:

Enclosed is a new travel voucher which has been prepared for Dr. Teller covering per diem claim for January 16. If the voucher and trip report are in order now, please have Dr. Teller sign as indicated by red check and forward to Mr. Rodriguez in our Washington Office.

The check you sent us has been returned to our Washington Office for cancellation and a new check will be issued.

We are returning the Standard Forms 50 since they are Dr. Teller's copies. The phrase "When Actually Employed" takes care of the time reported for January 16 only.

We are sorry for the misunderstanding which has delayed payment to Dr. Teller and hope that this will take care of the situation.

Very truly yours,

M. Evelyn Michaud

M. Evelyn Michaud,
Administrative Officer

Encls:

February 10, 1953

Mrs. M. Evelyn Michaud
Institute for Numerical Analysis
National Bureau of Standards
405 Hilgard Avenue
Los Angeles 24, California

Dear Mrs. Michaud:

There seems to have been some misunderstanding with regard to Dr. Teller's claim for reimbursement for his services at the last AMAC meeting held January 15 and 16 in Los Angeles. Dr. Teller spent only one day, January 16, in Los Angeles. It is true that he incurred the expense of a hotel on the night of January 15 in connection with his attendance the following day, but I assume that this expense is included in the per diem, under your business policies. It is correct that Dr. Teller is not claiming travel expenses.

I am therefore returning to you all the pertinent papers that you have sent Dr. Teller, with the request that you be kind enough to revise them, or issue new ones, to cover services and per diem for one day only, namely, January 16.

I am sorry to cause you this extra inconvenience and work, and regret the misunderstanding that has occasioned the additional effort. Dr. Teller's trips are frequently rather involved and complicated, and do require considerable analysis and breakdown for accounting purposes! Please accept our apologies, and our appreciation of your assistance in this situation.

Very truly yours,

(Mrs.) Ruth P. Brockett
Secretary to Edward Teller

Encls.:- Check #18,927,789
Pay Roll Change Slip
Notif. of Personnel Action (2)
Travel Voucher (5)

P.S. I'll keep the envelope addressed to Mr. Rodriguez, if I may, for future action.

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
NATIONAL APPLIED MATHEMATICS LABORATORIES

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR NUMERICAL ANALYSIS
UNIVERSITY OF CALIFORNIA
405 HILGARD AVENUE
LOS ANGELES 24, CALIF.

IN YOUR REPLY
REFER TO FILE NO.

February 4, 1953

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley, California

Dear Dr. Teller:

Enclosed is a travel voucher and trip report covering your per diem claim of $18.00 for attendance at the AMAC meeting January 15 and 16. Travel expenses are not shown as it is our understanding that you do not wish to claim them.

If the voucher and trip report appear to be in order, please sign as indicated by red check, and forward all papers to our Washington Office in the enclosed self-addressed envelope.

It was a pleasure to have you with us again.

Very truly yours,

M. Evelyn Michaud

M. Evelyn Michaud,
Administrative Officer

Encls:

January 6, 1953

Dr. Edward Teller
Radiation Laboratory
Box 808
University of California
Livermore, California

Dear Dr. Teller:

Enclosed is an amendment to the Charter of the Applied Mathematics Advisory Council. It is suggested that it be attached to the bound copy of the Charter which is in your possession. ?

Very truly yours,

J. H. Curtiss

J. H. Curtiss,
Executive Secretary
Applied Mathematics Advisory Council

Encl.

AMENDMENT NUMBER 1

(Approved at the AMAC meeting of November 7, 1952)

Replace the third sentence in Section 6, OFFICERS, by the following sentence: "The Chairman shall be a member other than the Chief of the NAML, and shall be elected for a term of one year".

January 26, 1953

Mrs. M. Evelyn Michaud
Administrative Officer
National Bureau of Standards
Institute for Numerical Analysis
University of California
405 Hilgard Avenue
Los Angeles 24, California

Dear Mrs. Michaud:

I am enclosing the bill for Dr. Teller's stay at the Westwood Manor on January 15, an expense incurred in connection with the Meeting of the American Mathematics Advisory Council. I do not know whether or not you need it, nor precisely what arrangements are made regarding reimbursement for meals and other items.

I assume that Dr. Teller saw you when he was in Los Angeles and filled out the forms required for his being paid the consultant fee. Also, I assume that he turned back to you the Government TRs which he did not need to use.

If you require any further information, please let me know.

Very truly yours,

(Mrs.) Ruth P. Brockett
Secretary to Edward Teller

Encl.

TH. 3-2740

GSA
PBS TELETYPE

1953 JAN 9 AM 10 29

CONFIRMATION COPY
This is a confirmation copy of a message telephoned
to P. De Lucca
on 1-9-53 at 10:30 a.M.
GENERAL SERVICES ADMINISTRATION
PUBLIC BUILDINGS SERVICE
KLondike 2-2350 Ext. 6960
Tel. By A. Byrne

426 SF LA

K377 PBS NBS /C-NBS/

LOS ANGELES 1-9-53 943 A

DR EDWARD TELLER

UNIVERSITY OF CALIFORNIA

RADIATION LABORATORY

BERKELEY, CALIFORNIA

CORRECTING TELETYPE MICHAUD TO YOU DATED 1/7/53 RE AMAC MEETING. THE DATES ARE JANUARY 15-16 NOT JUST JANUARY 16 WITH FORMAL PROGRAM ON JANUARY 16 AND INSPECTIONS OF INA AND HURRICANE ON JANUARY 15.

J H CURTISS, CHIEF, DIVN. 11, NBS INA LA

1/7/53 ~~-.-8 15-16 XXX~~ AMAC 15-16 16 16 15

MM 945 A

January 8, 1953

Dr. John Pellam, Acting Chief
Cryogenic Section
National Bureau of Standards
Washington 25, D. C.

Dear Dr. Pellam:

Thank you for your letter of December 29th, which caused me quite a headache. I think the answer is that both Landau and also de Hoffmann and Teller are right (strange as it may seem).

You are of course right that the problems of propagation of sound quanta with sound velocity and the propagation of light quanta with light velocity are quite similar. There is one difference due to a special property of the Lorentz transformation. When going from one reference system (x,t) to another reference system (x′, t′), one has

$$x' = \frac{x + vt}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$t' = \frac{t + \frac{vx}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}$$

For the case in which we are interested, one may set the square root in the denominator equal to unity. But even so, the equation does not reduce to the usual Galilean transformations because there is in the second equation the extra term

$$\left(\frac{vx}{c^2}\right)$$

In the case of Landau's sound quantum problem this term is of no importance. In the case of the light quantum problem, however, the time differences in which one is interested are very small and the term

$$\left(\frac{vx}{c^2}\right)$$

is of importance. The effect of this term is that if you make a transformation from one system to another, the density of light quanta which travel in the same direction is decreased, while the density of the light quanta traveling in the opposite direction is

...consequently cooled, thus causing water vapor
...mosphere to be converted into ice.

increased. This gives rise to the peculiar situation that the distribution of the quanta in the moving coordinate system is not given by a simple transformation of the distribution of quanta in the rest system and that the equations from which you start at the bottom on page one of your letter are not applicable.

I am also going to discuss this matter with Brickwedde, since the problem is really quite interesting and since I know that he has been concerned with these matters.

Very truly yours,

Edward Teller

cc: F. G. Brickwedde

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS

IN YOUR REPLY
REFER TO FILE

December 29, 1952

3.3

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley, California

Dear Dr. Teller:

My purpose in writing is to ask you a question concerning a paper by you and F. de Hoffmann in Phys. Rev. 80, 692 (1950), entitled "Magneto-Hydrodynamic Shocks."

I notice in this paper that you treat the effective mass of the relativistic gas as E/c^2 where E is the energy, and c the velocity of light. This is perfectly reasonable, is the way that Curtis also expressed mass, and is certainly the result that one would intuitively arrive at.

My interest in this concerns the alternative manner in which Landau [J. Phys. U.S.S.R., 5, 71 (1941)] arrives at what I believe is the analogous result in the case of a "phonon gas". Since the momentum p of a phonon is given by $p = \varepsilon/c$, where c here is the ordinary sound velocity and ε the phonon energy, the treatment of "wave propagation in the phonon gas" in liquid helium near absolute zero should be quite analogous to sound propagation in the relativistic gas considered by you and de Hoffmann.

However Landau arrives at the result $\frac{4}{3}E_{ph}/c^2$ for the effective mass, in terms of the phonon energy, Eph. He does this by expressing the distribution function for a system of phonons at net translational velocity V as

$$\frac{1}{\left(e^{\frac{pc-p\cdot V}{KT}}-1\right)} \; ; \text{ i.e. } \frac{1}{e^{(pc-p\cdot V)/KT}-1}$$

i.e. Einstein-Bose distribution including the Doppler correction.

Then the momentum density due to velocity V becomes

$$\iint \frac{(p\cos\theta)2\pi p^2 dp \sin\theta d\theta}{e^{(pc-pV\cos\theta)/KT}-1}$$

... subsequently cooled, thus causing water vapor ... the atmosphere to be converted into ice.

Since $V \gg c$, Landau expands the denominator

$$e^{(pc-pV\cos\theta)/KT}-1 \simeq (e^{pc/KT}-1)\left[1-\frac{pV}{KT}\cos\theta\,\frac{e^{pc/KT}}{e^{pc/KT}-1}\right]$$

Hence the expression for momentum becomes

$$\iint \frac{p\cos\theta\; 2\pi p^2 dp\; \sin\theta d\theta}{e^{pc/Kt}-1} + \frac{V}{KT}\iint \frac{e^{pc/Kt}(p\cos\theta)^2 2\pi p^2 dp\; \sin\theta d\theta}{(e^{pc/Kt}-1)^2}$$

where the first term equals zero for reasons of symmetry. Evaluating the second term by integrating over momentum p by parts, the resultant momentum density becomes

$$\frac{4}{3}\frac{V}{c^3}\int \frac{(pc)4\pi p^2 dp}{(e^{pc/KT}-1)}$$

which is simply the expression for

$$\frac{4}{3}\frac{V}{c^2}\,E_{ph}$$

where $E_{ph} = \int \frac{\varepsilon\, 4\pi p^2 dp}{e^{pc/KT}-1}$, ($\varepsilon$ = pc), is the phonon energy.

Thus by this method Landau obtains

$$M = \frac{4}{3}\frac{E_{ph}}{c^2}$$

as the effective phonon mass in terms of Eph and the phonon (i.e. sound) velocity c.

The factor 4/3 is later compensated by other thermodynamic quantities. These, I believe, are really expressing the condition of adiabaticity, so that the $\gamma = 4/3$ for a radiation gas cancels out the 4/3 in the mass term, giving the same value $v = c/\sqrt{3}$ as you obtained.

The question is this. Shouldn't you have a factor 4/3 in your mass expression, and shouldn't you also have a 4/3 appearing if the oscillations are adiabatic? If for example Landau's $4/3\ E_{ph}/c^2$ were not correct, the $\gamma = 4/3$ would give a velocity of $(c/\sqrt{3})\sqrt{4/3}$ due to adiabicity, or 2/3 c as the effective velocity of phonon wave propagation.

NATIONAL BUREAU OF STANDARDS

I know that you are very busy, but if you could clarify this for me I would be most grateful. I am sending Brick a copy, so that if you don't get a chance to give a written reply you could pass the word along verbally via him. Thank you very much for any comments you may care to make.

Very truly yours,

John R. Pellam

John R. Pellam, Acting Chief
Cryogenics Section

cc Dr. Brickwedde

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
NATIONAL APPLIED MATHEMATICS LABORATORIES

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR NUMERICAL ANALYSIS
UNIVERSITY OF CALIFORNIA
405 HILGARD AVENUE
LOS ANGELES 24, CALIF.

IN YOUR REPLY
REFER TO FILE NO.

January 5, 1953

WESTERN UNION

1206

W. P. MARSHALL, PRESIDENT

DOMESTIC SERVICE	
Check the class of service desired; otherwise this message will be sent as a full rate telegram	
FULL RATE TELEGRAM	
DAY LETTER	X
NIGHT LETTER	

INTERNATIONAL SERVICE	
Check the class of service desired; otherwise this message will be sent at the full rate	
FULL RATE	LETTER TELEGRAM
VICTORY LETTER	SHIP RADIOGRAM

NO. WDS.-CL. OF SVC.	PD. OR COLL.	CASH NO.	CHARGE TO THE ACCOUNT OF	TIME FILED
	COLLECT			

Send the following message, subject to the terms on back hereof, which are hereby agreed to

Mr. L. O. Rodriguez
National Applied Mathematics Laboratories
National Bureau of Standards
Washington, D. C.

Plan to attend AMAC meeting January sixteen. Please send travel requests.

Edward Teller

Encls: 4

Administrative Officer

fil

the atmosphere to be converted into ice.

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
NATIONAL APPLIED MATHEMATICS LABORATORIES

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR NUMERICAL ANALYSIS
UNIVERSITY OF CALIFORNIA
405 HILGARD AVENUE
LOS ANGELES 24, CALIF.

IN YOUR REPLY
REFER TO FILE NO.

January 5, 1953

DOMESTIC SERVICE
Check the class of service desired; otherwise this message will be sent as a full rate telegram

FULL RATE TELEGRAM	
DAY LETTER X	NIGHT LETTER

WESTERN UNION

1206

INTERNATIONAL SERVICE
Check the class of service desired; otherwise this message will be sent at the full rate

WESTERN UNION

1204

CLASS OF SERVICE
This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.

Phoned 1025 am MM

W. P. MARSHALL, PRESIDENT

SYMBOLS
DL=Day Letter
NL=Night Letter
LT=Int'l Letter Telegram
VLT=Int'l Victory Ltr.

The filing time shown in the date line on telegrams and day letters is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination

NO 5 SF GOVT PD 2 EXA SAN FRANCISCO CALIF 841 AM DEC 30

DR EDWARD TELLER
RADIATION LAB BOX 808
UNIV OF CAL, LIVERMORE CAL

NEXT AMAC MEETING JANUARY 16TH AT INSTITUTE FOR NUMERICAL ANALYSIS ON UCLA CAMPUS L A PLEASE ADVISE MR RODRIGUEZ COLLECT WHETHER OR NOT YOU CAN ATTEND SO TRAVEL REQUESTS MAY BE AIR MAILED

J H CURTISS
NATION, BUREAU OF STANDARDS 11.0 DEPT OF COMMERCE WASHINGTON DC

950 AM

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
NATIONAL APPLIED MATHEMATICS LABORATORIES

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR NUMERICAL ANALYSIS
UNIVERSITY OF CALIFORNIA
405 HILGARD AVENUE
LOS ANGELES 24, CALIF.

IN YOUR REPLY
REFER TO FILE NO.

January 5, 1953

DOMESTIC SERVICE
Check the class of service desired; otherwise this message will be sent as a full rate telegram

FULL RATE TELEGRAM		
DAY LETTER	X	NIGHT LETTER

WESTERN UNION

1206

W. P. MARSHALL, PRESIDENT

INTERNATIONAL SERVICE
Check the class of service desired; otherwise this message will be sent at the full rate

FULL RATE		LETTER TELEGRAM	
VICTORY LETTER		SHIP RADIOGRAM	

NO. WDS.-CL. OF SVC.	PD. OR COLL.	CASH NO.	CHARGE TO THE ACCOUNT OF	TIME FILED

Send the following message, subject to the terms on back hereof, which are hereby agreed to

Mr. L. O. Rodriguez
National Bureau of Standards
Washington 25, D. C.

Dr. Edward Teller regrets that he is unable to attend meeting of Advisory Council on November 7. Transportation Requests being returned under separate cover.

Ruth Brockett

Encls: 4

Administrative Officer

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
NATIONAL APPLIED MATHEMATICS LABORATORIES

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR NUMERICAL ANALYSIS
UNIVERSITY OF CALIFORNIA
405 HILGARD AVENUE
LOS ANGELES 24, CALIF.

IN YOUR REPLY
REFER TO FILE NO.

January 5, 1953

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley, California

Dear Dr. Teller:

This is in further reference regarding the forthcoming meeting of the American Mathematics Advisory Council in Los Angeles, January 16, 17, and 18, 1953.

Since the Bureau will defray the cost of your travel expenses, we have prepared a travel order to cover your trip from Berkeley, California to Los Angeles and return. We are enclosing three (3) Government Requests for Travel (Nos. C-389,979, C-389,980 and C-389,981) which you may use in purchasing the necessary travel tickets. Also enclosed is a travel book with special instructions which will aid you in your travel.

We regret that the execution of some additional papers before the meeting will be necessary in order that you may be paid the regular fee of $41.52 per day for your services. Therefore, it would be helpful if you could come to the Institute say about 1/2 hour in advance of the AMAC meeting. The Institute for Numerical Analysis is located in Building 3-U on the campus of the University of California in Los Angeles. i.e. be there ca. 9:30 AM

Should you desire Hotel Reservations, kindly let us know of your needs and date of arrival and we will be glad to procure them for you.

Very truly yours,

M. Evelyn Michaud

M. Evelyn Michaud,
Administrative Officer

Encls: 4

Astin

June 22, 1960

Dear Dr. Astin:

The notification concerning the new members of the National Academy has just been sent to me from Washington. It was wonderful to see that you have been elected as a member of the Academy. Let me offer my sincere congratulations on this honor which has been long overdue.

Sincerely yours,

ET:gg

Dr. Allen V. Astin, Director
National Bureau of Standards
Washington, D. C.

December 13, 1955
Ref: 30.0

Dr. C. N. Coates
National Bureau of Standards
Washington 25, D.C.

Dear Dr. Coates:

Dr. Teller has asked me to acknowledge your letter of November 29th regarding the meeting of the NBS Policy Committee scheduled for January 23rd in Washington.

By this time, you have probably seen Dr. Teller personally and are aware that he will be unable to accept the invitation because of scheduled hospitalization at that time. He regrets exceedingly that he will be unable to come, and has asked me to thank you for extending the invitation.

Sincerely yours,

(Mrs.) Joan Jaffray
Secretary to Edward Teller

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

November 29, 1955

IN YOUR REPLY
REFER TO FILE NO.
30.0

*

Dr. Edward Teller
University of California
Radiation Laboratory
Berkeley 4, California

Dear Dr. Teller:

As you may recall, members of the National Bureau of Standards Technical Advisory Committee from the Policy Committee for Mathematics issued a standing invitation sometime ago for you to attend meetings of their Committee held at the Bureau.

This is to advise you that a meeting of that group has been called for January 23, 1956, at 9:30 AM in Room 301 of the Bureau's South Building. I am sure that all parties concerned would be delighted to have you attend should you find it convenient.

Sincerely yours,

C. N. Coates

C. N. Coates
Assistant to the Director

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.
30.20
300-55

December 5, 1955

Mrs. Joan Jaffray
Secretary to Dr. E. Teller
Radiation Laboratory
University of California
Berkeley 4, California

Dear Mrs. Jaffray:

I regret the delay in acknowledging your letters of November 11 to Dr. Huntoon concerning the proposed and cancelled visit planned by Dr. Teller. Dr. Huntoon regrets very much that Dr. Teller finds it impossible to visit the Bureau at this time.

Since Dr. Teller, under new arrangements with the Radiation Laboratory, cannot accept consultation fees with other government agencies, this required a change in his appointment. Dr. Teller's letter of October 5 was the basis for personnel action in a form of resignation as a Consultant WAE (When Actually Employed). Another action followed setting up the appointment as a Consultant WOC (Without Compensation). Herewith are your copies of these personnel actions.

In view of the change in this appointment, I also enclose herewith a copy of the "Travel Instructions for Consultants" which should be reviewed prior to any planned trips. Some of the material may not apply to Dr. Teller since it is my understanding that he will be available for consultation only when he is in the east on other business. A copy of a blanket travel order is enclosed for your retention. As far as vouchers are concerned, you my prepare them yourself or submit the expenses on a separate sheet and have Dr. Teller sign a blank voucher which I would prepare and submit for payment. If you prefer preparing the vouchers, an original and three copies should be submitted to this office. I would appreciate knowing which method you plan to use.

If you have need for additional information, please do not hesitate to call on me.

Sincerely yours,

Florence G. Sharkey

(Mrs.) Florence P. Sharkey
Administrative Assistant

See NBS Contract file

Legends for Figures

Fig. 1. - A qualitative representation of the variation of temperature and pressure in the ball of fire.

Fig. 2. - The absorption coefficient of radiation by air as a function of wavelength.

Fig.3. - The fraction of black-body radiation penetrating normal atmosphere as a function of the temperature of the ball of fire.

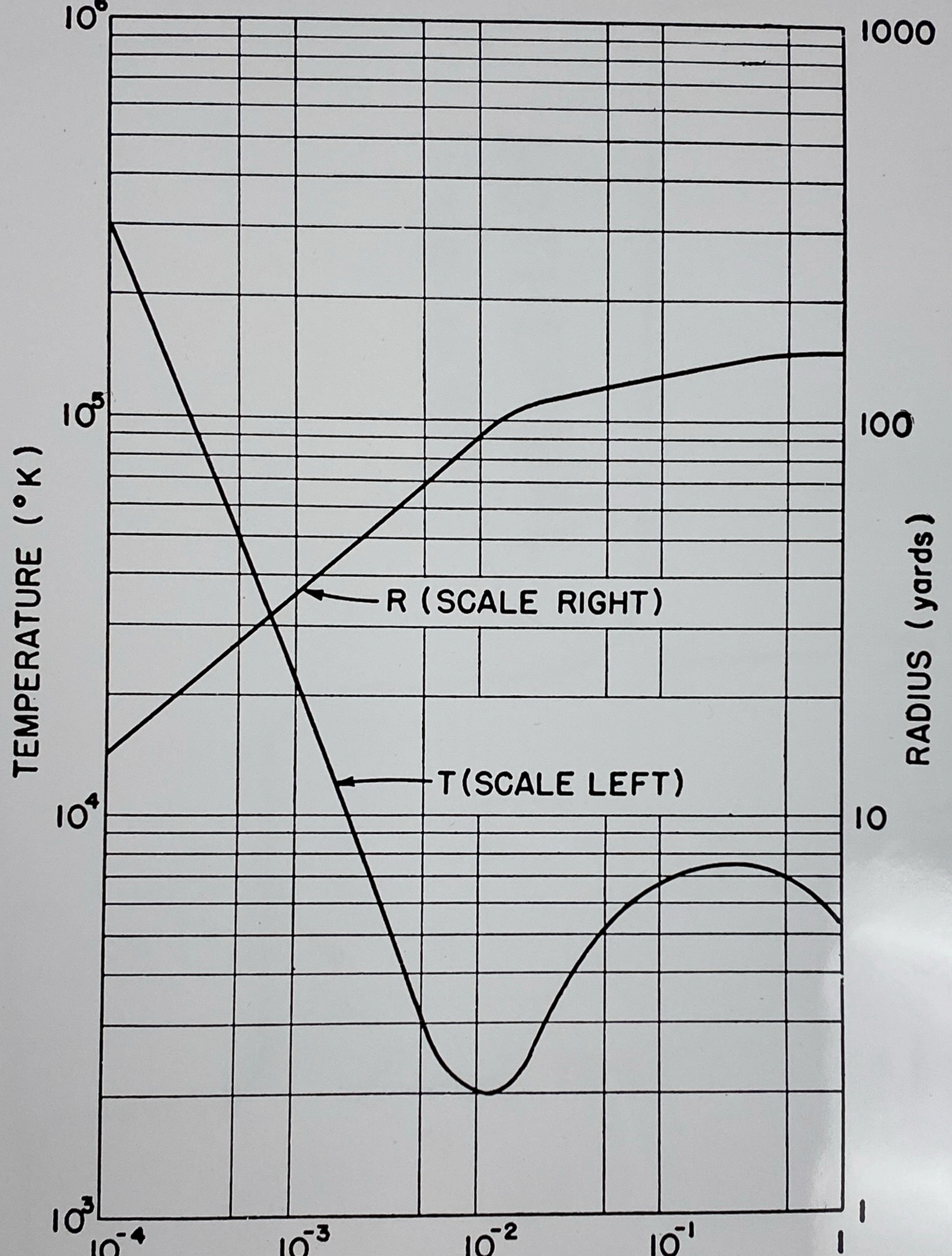
Fig. 4. - The temperature and radius of the ball of fire as a function of time after the explosion. The second stage of fireball growth begins at 10^{-4} second, and the third stage at 0.015 second.

Fig. 5. - A schematic, sectional diagram illustrating the position of the Radiation-Front inside the Pressure-Shock-Front. A marks the position of the Radiation-Front, and B the Pressure-Shock-Front. The spherical shell between these 2 fronts is cooler than the volume enclosed by the Radiation-Front.

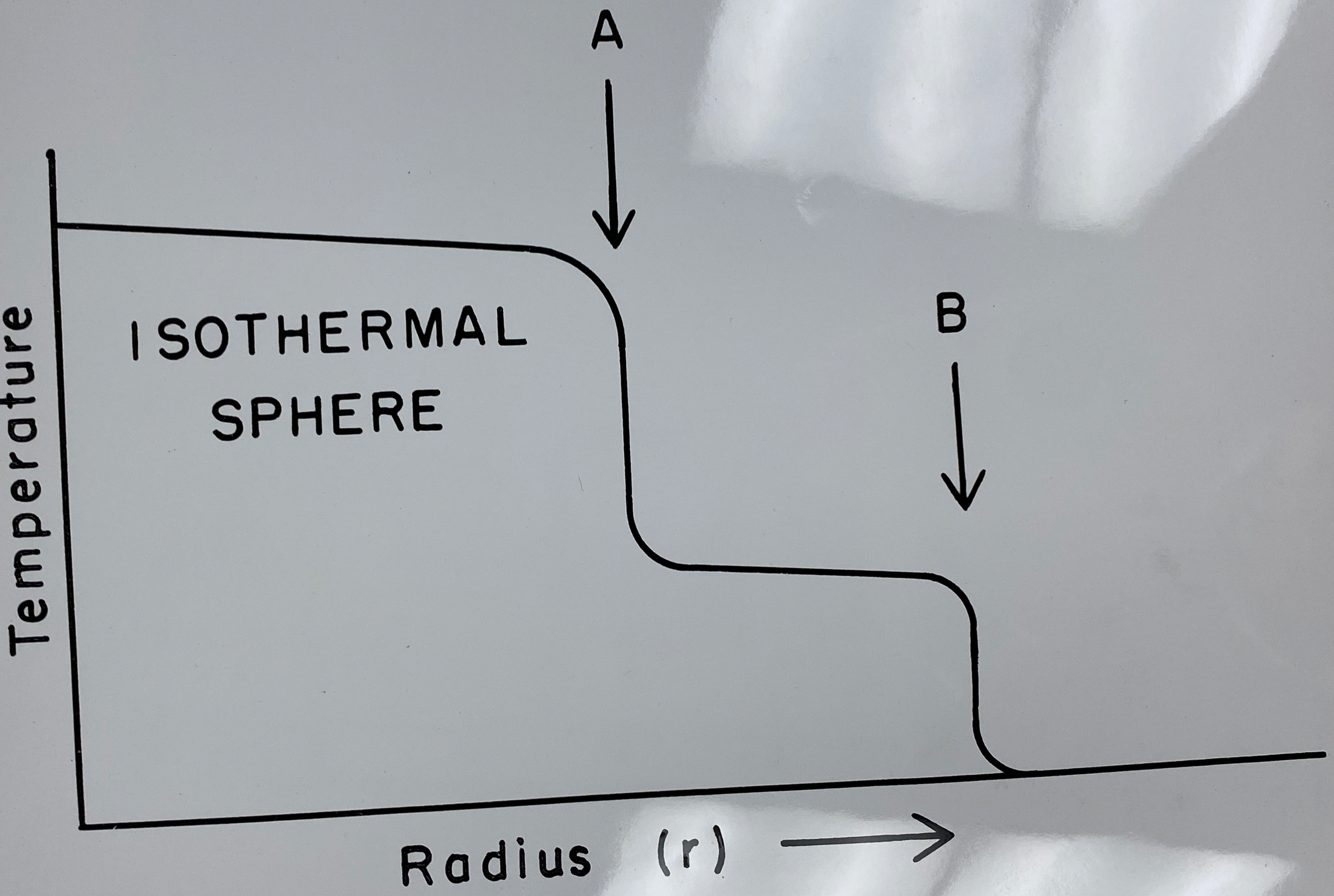
Fig. 6. - The ball of fire touching the ground, and the shock-front soon after it has broken away from the ball of fire, in the "Trinity" test at Alamogordo, N. M. in 1945. The Mach-front is due to a reflection of the shock-front at the ground.

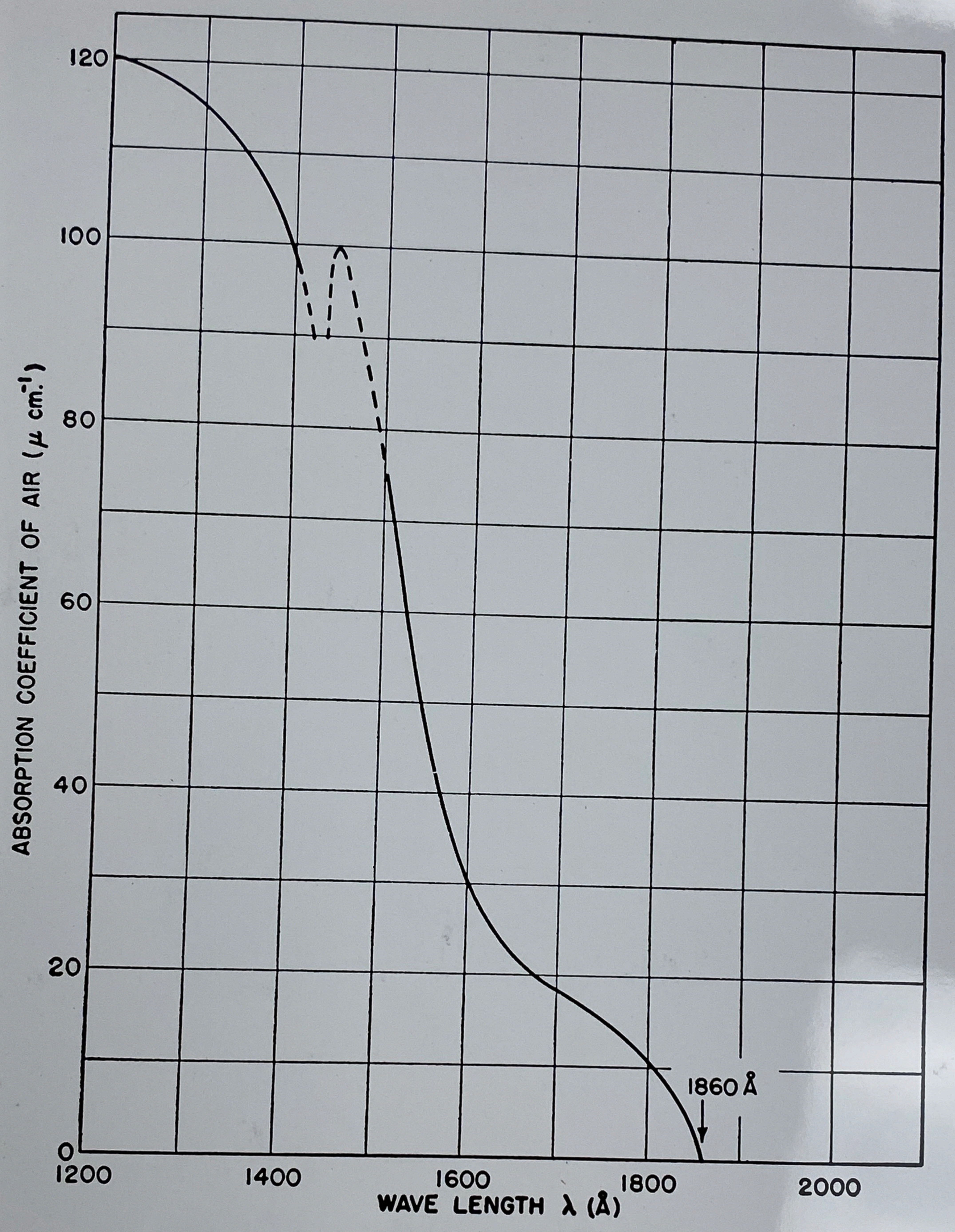
Fig. 7. - Illumination from the ball of fire as a function of time after the explosion. The ordinates represent $\sigma T^4 R^2$ (where R is the radius of the fireball) which is the radiation flux (or illumination) per unit solid angle. D is the distance of an observer from the fireball. A "sun" is a flux of energy equal to 0.032 cal cm^{-2} sec^{-1}, which is supposed to be the energy received from the sun at the top of the atmosphere.

Fig. 8. - The mushroom cloud attaining a height of 5 miles after an atomic explosion. The ice cap or scarf cloud at the top consists of myriads of small ice crystals; the gases above the mushroom expand ahd are consequently cooled, thus causing water vapor in the atmosphere to be converted into ice.

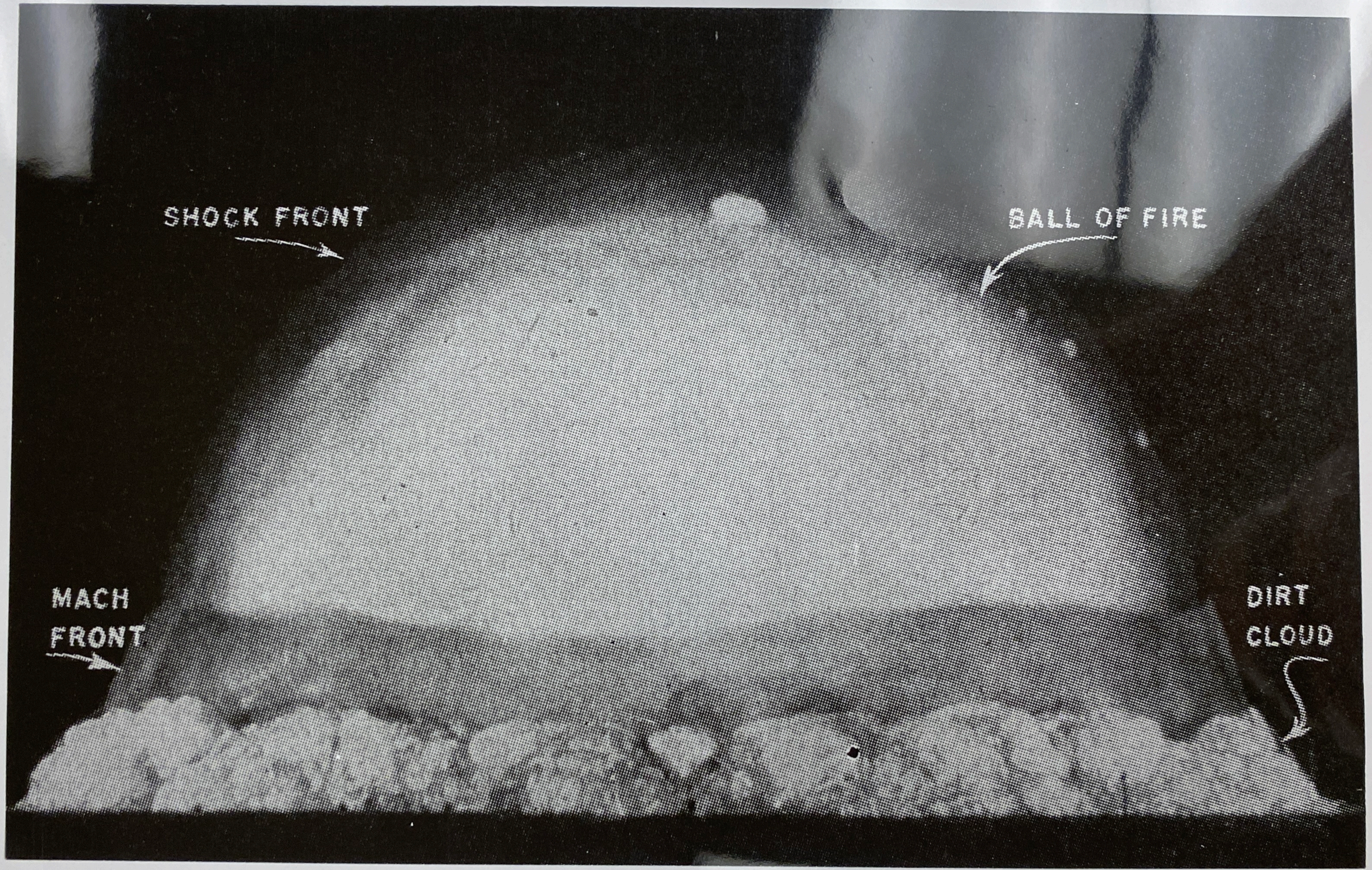


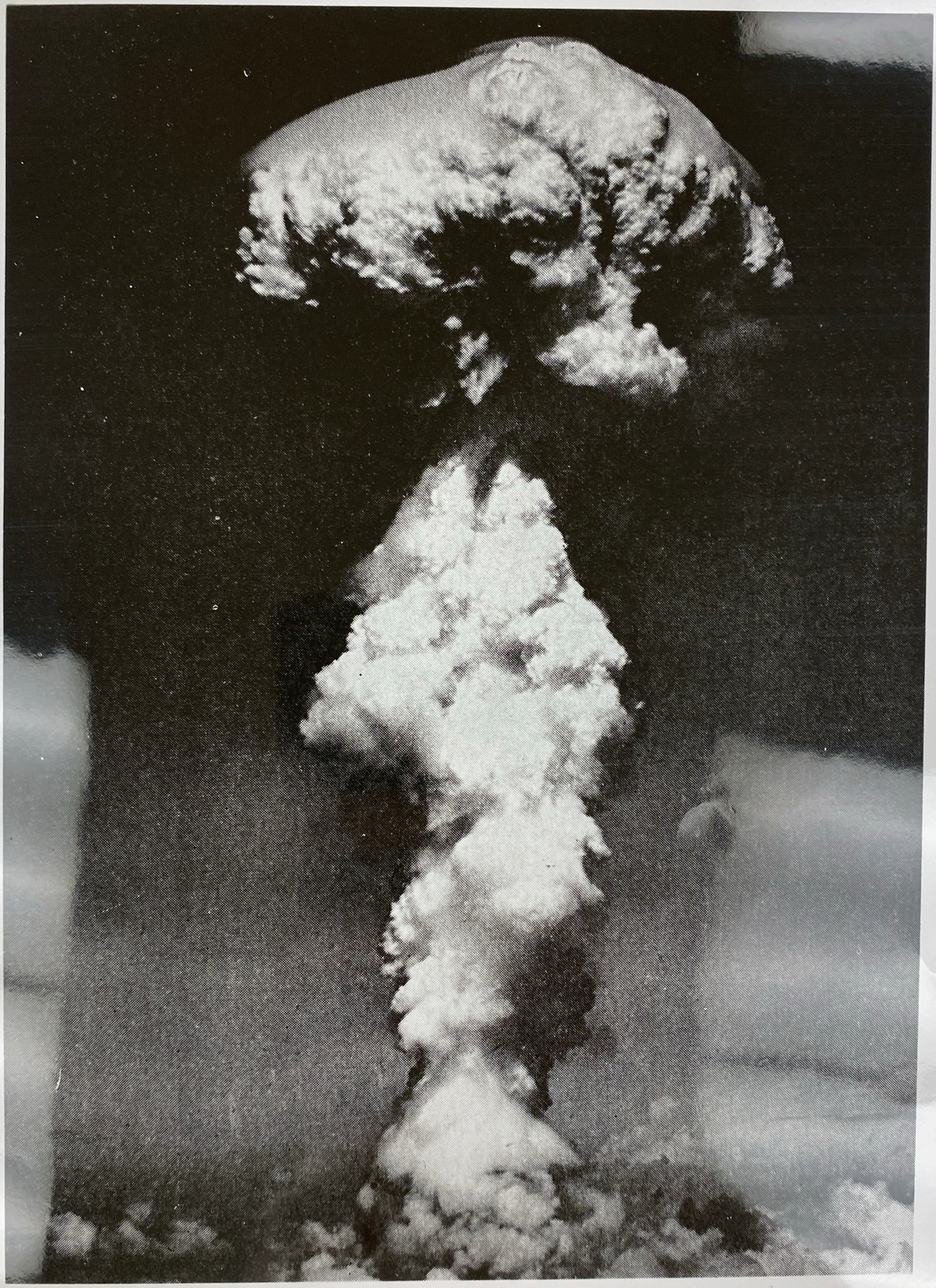
10⁶
10⁵
10⁴
10³
1000
100
10
1
TEMPERATURE (°K)
RADIUS (yards)
R (SCALE RIGHT)
T (SCALE LEFT)
10⁻⁴
10⁻³
10⁻²
10⁻¹
1
TIME (sec.)


A
B
ISOTHERMAL
SPHERE
Temperature
Radius (r)

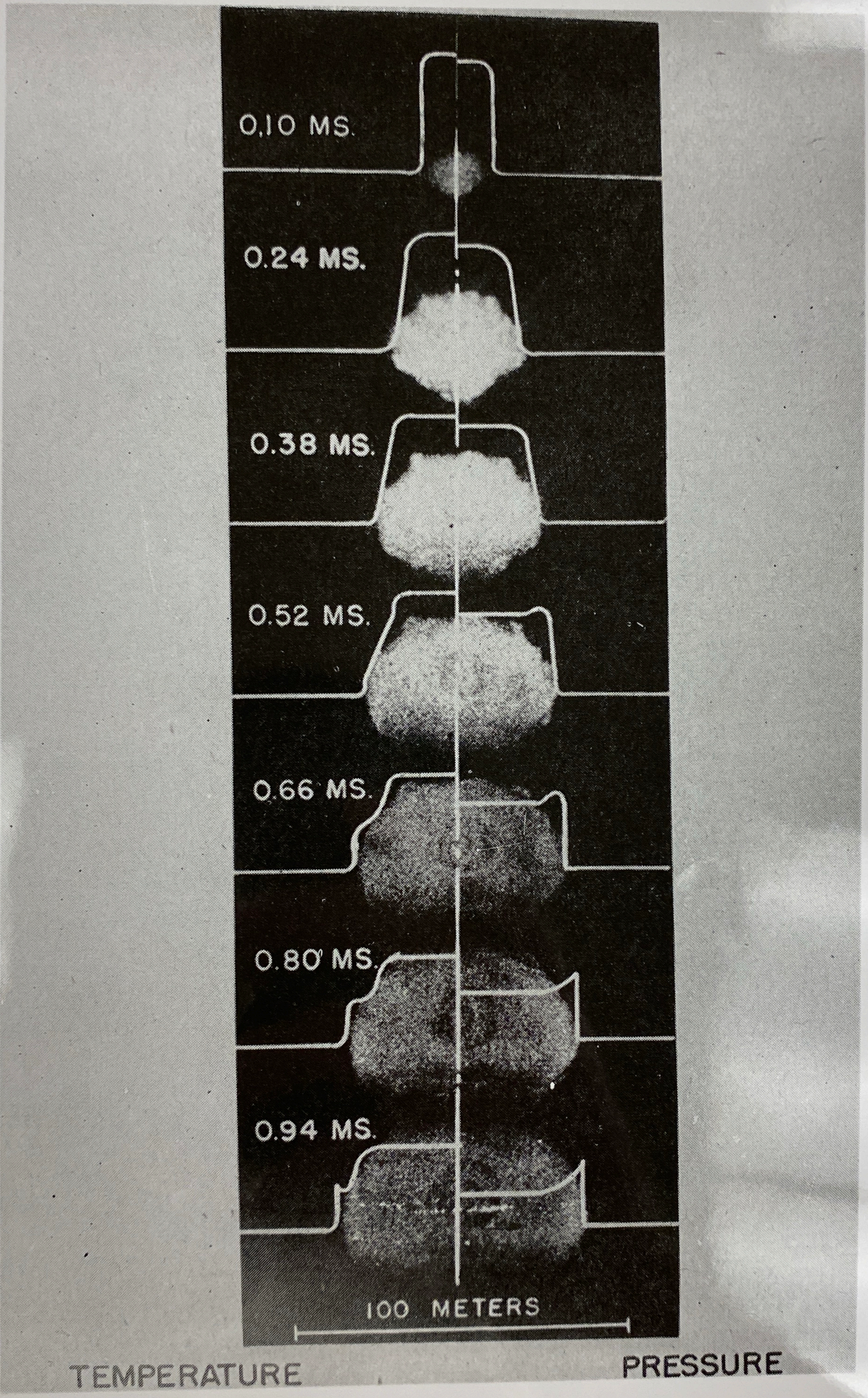


ABSORPTION COEFFICIENT OF AIR (μ cm.⁻¹)
120
100
80
60
40
20
0
1200
1400
1600
1800
2000
WAVE LENGTH λ (Å)
1860 Å


SHOCK FRONT
BALL OF FIRE
MACH FRONT
DIRT CLOUD



U.S. DEPARTMENT OF COMMERCE



U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
BOULDER LABORATORIES
BOULDER, COLORADO

September 27, 1960

CRYOGENIC ENGINEERING LABORATORY
CENTRAL RADIO PROPAGATION LABORATORY
RADIO STANDARDS LABORATORY

IN REPLY
REFER TO FILE NO.
87.70

Air Mail

*
Dr. Edward Teller
University of California
Pasadena, California

Dear Dr. Teller:

I am writing in response to the invitation which you kindly made to me when we met by chance in the Tetons last month. I shall be at Monterey on October 12-14 for the Gaseous Electronics Conference, and should like very much to visit your laboratory on October 11 in order to talk with those people there who are most interested in problems of the Van Allen belts and the geomagnetic field.

I enclose two copies of a preliminary note which I wrote up on the work we discussed. Would you be so kind as to pass these on to those who may be interested?

Sent one to Steve White

Sincerely,

Nathaniel Carleton

Nathaniel Carleton
Airglow and Aurora Section
Upper Atmosphere and Space Physics

Enclosures 2

NPC:bs

Called 10/11 9 am
Public phone
&
GG made arrangement for him to go to Livermore to see White

1203
112

Gen Eg Mss

June 27, 1963

Dr. R. P. Hudson, Chief
Heat Division
National Bureau of Standards
207 West Building
Washington 25, D. C.

Dear Dr. Hudson:

Thank you for your letter of June 17th, which I found to be most interesting.

I was not aware of the quanitative situation of helium gas. I do not feel at the present time that I know enough about its availability and requirements to make a relevant contribution. However, you have stimulated my interest and in the course of time I may have more to offer.

Sincerely yours,

Edward Teller

ET:gg

U.S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D.C.
207 West Building

IN YOUR REPLY
REFER TO FILE NO.

June 17, 1963

3.0

Professor E. Teller
Lawrence Radiation Laboratory
California Institute of Technology
Pasadena, California

Dear Professor Teller:

As you are doubtless aware, the helium gas possessed by the United States is an extremely valuable but at the same time vanishing asset. The Department of the Interior does have a conservation program under way but the wastage remains enormous and one naturally questions whether the nation can afford this profligacy.

A Committee of Government representatives, upon which I am privileged to serve, is presently working to substantiate a case for a more intensive effort at conservation. Current usage of helium stands at 0.8 billion cu. ft. per annum and may rise to 2 billion p.a. by 1985. The estimated U. S. recoverable resources of 154 billion cu. ft. in 1961 were being depleted at the rate of 4 billion per year as waste product in the burning of natural gas! If the presently planned conservation program can be fully implemented the wastage will still amount to at least 30 billion cu. ft. over the next 22 years. [Some 35 billion will have been usefully employed (though still lost) by 1985; 35 billion will remain plus another 50 billion returned to underground storage.]

The question of how extensive our conservation program should be turns on how much money is the Congress prepared to spend upon it and upon our ability to estimate the Nation's helium needs into the indefinite future. Accordingly, we are seeking opinions from leading members of the scientific community so that we can feel confident that the best possible evaluation of the problem has been made. While you may or may not feel a direct personal involvement in this problem I am sure you are aware of its existence and that you most probably do have some opinions on it. Any comments or suggestions that you can provide will be highly valued by the Committee, and it is with the hope that you share the Committee's estimate of the importance of this study that I am taking the liberty of sending you this letter.

Yours sincerely,

R. P. Hudson

R. ~~P.~~ Hudson, Chief
Heat Division

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.
30.20
64-56

February 28, 1956

Dr. Edward Teller
Radiation Laboratory
University of California
Berkeley 4, California

Dear Dr. Teller:

I am, with this letter, availing myself of your offer "to be of assistance regarding our new computer if I can indicate the where and how".

Recently a Dr. John Pasta from the Research Division paid us a visit to look into the plans for the computer. The gist of the conversation would indicate the AEC needs for the development of new machines would be his responsibility, via research division of course.

We also gathered that he might be more favorable toward using existing machines than developing better ones. None of this was explicitly stated however.

If Dr. Pasta is to be the one charged with making the decision we would like to press our case with him. If not, we do not wish to push him into a final position only to find that he didn't have as much authority as he and/or we seemed to think, and put him in the position of finding us going around him.

By now the assistance we seek from you should be clear. Can you please quietly ascertain for us just what part in the future of computers for the AEC Dr. Pasta is supposed to play, in particular of course as related to the decision regarding possible AEC interest in the new NBS design.

I will appreciate your assistance if you feel you can give it in this instance. If not, a reply indicating this will be helpful. If you feel the request is not appropriate please do not hesitate to say so.

I hope you are by now fully recovered from your sojourn with the medics. Thanks in advance.

Sincerely yours,

R D Huntoon

R. D. Huntoon
Associate Director for Physics

UNIVERSITY OF CALIFORNIA

RADIATION LABORATORY
BERKELEY 4, CALIFORNIA

January 23, 1956

Dr. R. D. Huntoon
Associate Director for Physics
U.S. Department of Commerce
National Bureau of Standards
Washington 25, D.C.

Dear Dr. Huntoon:

Mrs. Jaffray has told me that you telephoned last Friday requesting information on the progress of discussions on the NBS machine for your Policy Committee meeting today.

Confirming the conversation, I have discussed this matter with Commissioner von Neumann. He is clearly aware of the situation, and favorably inclined to your plans. When I talked to him briefly in Washington last week, the state of his health did not permit detailed planning; however, I will keep in touch with him and let you know what progress is being made. Until I can spend more time discussing the matter with him, I don't feel there is anything further I can do.

Thanks very much for your good wishes for a speedy recovery. I am recuperating very nicely and expect to be mobile within a few weeks.

Looking forward to seeing you soon,

Edward Teller

ET:jj

NBS

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

WASHINGTON 25

ADDRESS REPLY TO BUREAU

REFER TO FILE

January 17, 1956 11.0

Dr. Robert Richtmyer
Institute of Mathematical Sciences
New York University
253 Greene Street
New York 3, New York

Dear Dr. Richtmyer:

This letter, with attachments, is a follow-up of the meeting at the National Bureau of Standards on December 9 at which the important aspects of a new very fast Digital Computer being considered for the Applied Mathematics Division were presented and discussed. You will remember that you with your other colleagues from the Atomic Energy Commission who are also receiving copies of this material, requested that we commit the essential features of this machine to paper in very condensed form, and send it to all A.E.C. representatives present, along with some additional copies for internal use. This has been done and we hope you will find the information helpful in your careful consideration of the impact of a machine of this power on the computation program and needs of the A.E.C.

Some of the numbers may be a little surprising. In the time which has elapsed since the December 9 meeting, it has been ascertained that, with no sacrifice of simplicity and reliability of design, the over-all operation speed of the computer can be raised to 150 times that of SEAC, an increase of 50% over the speed indicated in that meeting.

As you may remember, the conception of this machine is a direct result of recommendations made by our Technical Advisory Committee for Mathematics.

This committee, appointed by the Policy Committee for Mathematics at the request of the Secretary of Commerce, consists of:

Dean Mina Rees, Chairman
Professor Philip M. Morse
Professor David Blackwell
Dr. E. U. Condon
Professor A. H. Taub
Professor Mark Kac

At their request, a careful and extensive survey of the computational needs of N.B.S. was made. The survey clearly established the need for a computer at least one hundred times as fast as SEAC, and the committee unanimously recommended that we lay plans for such a machine and explore ways and means for its realization.

As a part of this exploration, we feel that the A.E.C. may well find that it also has an important stake in the existence of such a powerful computing machine or machines. I use the plural here because one of the important aspects of this computer is the ease with which it may be copied at reduced cost, without a large skilled staff, by other scientific laboratories whose computational needs are comparable with those of N.B.S.

If our thinking here about the extent of A.E.C. interest is correct, close collaboration with the appropriate laboratories of the Commission is indicated, for such a development should be aimed at meeting the joint requirements of both agencies. It would therefore be helpful, once you have had the opportunity to discuss the attached plans with your associates, if we can have an indication of the nature and extent of the interest of the A.E.C. Laboratories in the existence of a computer embodying the design principles indicated.

Very truly yours,

Original signed by
R. D. HUNTOON

R. D. Huntoon
Associate Director for Physics

ORIGINAL

FILL IN CITY OR STATE IN BLOCKOUT

Form W-2
U. S. Treasury Department
Internal Revenue Service

WITHHOLDING STATEMENT—1953
Federal Taxes Withheld From Wages

EMPLOYER (Print employer's identification number, name, and address below)

U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington 25, D. C.

EMPLOYEE (Print employee's social security account number, name, and full address below)

Edward Teller
P. O. Box 808
Livermore, California

U. S. INCOME TAX WITHHOLDING INFORMATION
(TO BE REPORTED ON EMPLOYEE'S INCOME TAX RETURN)

Total wages (before payroll deductions) paid in 1953: $ 41.52

Federal income tax withheld, if any: $ -0-

SINGLE | MARRIED

FEDERAL INSURANCE CONTRIBUTIONS ACT
(FEDERAL OLD-AGE AND SURVIVORS INSURANCE)

Total F.I.C.A. wages (before payroll deductions) paid in 1953*: $ 41.52

F.I.C.A. employee tax withheld, if any: $ .62

NOTICE TO EMPLOYEE: This statement is important, and should not be lost or mislaid. It must be attached to your U. S. income tax return for 1953. SEE OTHER SIDE.
*If your wages were subject to F.I.C.A. taxes, but are not shown above, your F.I.C.A. wages are the same as wages shown under "U. S. INCOME TAX WITHHOLDING INFORMATION," but not more than $3,600.

APP. B.I.R. 10-9-52

EMPLOYEE RECEIVES FIRST TWO LEAVES

...HANGE SLIP—EMPLOYEE'S COPY

5. Employee's name (and social security account number when appropriate)
82306 TELLER, EDWARD

1. Agency and organizational de...
standards

4. Slip No.
7. Previous normal
8. New normal
9. Pay this period
10. Remarks:
BASE PAY OVERTIME
NET PAY

U. S. GOVERNMENT PRINTING OFFICE

COPY

In Reply Refer to
C:GLM

Dr. F. G. Brick...
Division of Hea...
National Bureau...
U. S. Departme...
Washington 25,...

Dear Dr. Brick...

This will co...
revised vers...
Explosions"...
Restricted D...

cc: R. C. Smith
D. J. Pflaum
W. A. Strauser

COPY

In Reply Refer to:

C:GLM

Dr. F. G. Brickwed
Division of Heat a
National Bureau of
U. S. Department o
Washington 25, D.

Dear Dr. Brickwed

This will confir
revised version
Explosions" in
Restricted Data

cc: R. C.
D. J.
W. A.

1954.

OO Acct 808

☆ U. S. GOVERNMENT PRINTING OFFICE: 1951 - 975416

1. Agency and organizational designations: standards

5. Employee's name (and social security account number when appropriate): 82306 TELLER, EDWARD 11.1 field

2. Pay roll period: 2/1-14/53

3. Block No.: #5 contract

4. Slip No.:

6. Grade and salary: Consultant 41.52 pd WAE

PAY ROLL CHANGE DATA

	BASE PAY	OVERTIME		GROSS PAY	RET.	TAX 4	BOND	F. I. C. A.			NET PAY
7. Previous normal											
8. New normal											
9. Pay this period				41.52	-	-	-	.62			40.90

10. Remarks:

paid herewith for 1 day worked 1/16/53.

Check issued on previous period for 2 days ~~has been canceled~~

11. Appropriation(s):

12. Prepared by: kb

13. Audited by:

☐ Periodic step-increase ☐ Pay adjustment ☐ Other step-increase

14. Effective date

15. Date last equivalent increase

16. Old salary rate

17. New salary rate

18. Performance rating is satisfactory or better.

(Signature or other authentication)

19. LWOP date (Fill in appropriate spaces covering LWOP during following periods): Period(s):

☐ No excess LWOP. Total excess LWOP

(Check applicable box in case of excess LWOP)
☐ In pay status at end of waiting period.
☐ In LWOP status at end of waiting period.

Initials of Clerk

STANDARD FORM NO. 1126a—Revised
Form prescribed by Comp. Gen., U. S.
Nov. 8, 1950, General Regulations No. 102

PAY ROLL CHANGE SLIP—EMPLOYEE'S COPY

C O P Y

UNITED STATES
ATOMIC ENERGY COMMISSION
Washington 25, D.C.

In Reply Refer to:

C:CLM

February 14, 1955

Dr. F. G. Brickwedde, Chief
Division of Heat and Power
National Bureau of Standards
U. S. Department of Commerce
Washington 25, D. C.

Dear Dr. Brickwedde:

This will confirm our conversation of this date concerning the revised version of your article entitled "Temperatures in Atomic Explosions" in which I advised you that it does not contain any Restricted Data.

Sincerely yours,

/s/ C. L. Marshall

C. L. Marshall
Deputy Director of Classification

cc: R. C. Smith
D. J. Pflaum
W. A. Strauser

DRAFT OF A PAPER FOR PUBLICATION BY

THE AMERICAN INSTITUTE OF PHYSICS IN A VOLUME OF COLLECTED PAPERS PRESENTED AT THIRD TEMPERATURE SYMPOSIUM AT THE N.B.S., OCTOBER 30, 1954.

F. G. Brickwedde
Chief, Heat and Power Division
National Bureau of Standards
and
Part-time Professor of Physics
University of Maryland

Temperatures in Atomic Explosions

§1. Introduction: An Intermediate Situation Between a TNT-Explosion and a Star.

Atomic explosions are in reality nuclear explosions because energy is released by a nuclear reaction in which nuclear bonds are broken, and protons and neutrons are rearranged to form other nuclei. In dynamite and TNT explosions the energy is released by a chemical reaction — an oxidation reaction — in which chemical bonds are broken and atoms are regrouped. The initial high temperature of a TNT explosion is about 5000°K; in atomic explosions it is of the order of 10,000,000°K. The heat of explosion of TNT is 2.0×10^5 calories (200 kcal) per mole of TNT[1], whereas the heat of fission of U^{235} or Pu^{239} is 4.5×10^{12} calories per mole, or 20,000,000 times greater. The initial high temperature of an atomic explosion, however, is of an order only 2000 times that of a chemical, TNT explosion. There is therefore a rather large difference between the ratio of energies released and the ratio of temperatures attained in the two kinds of explosions. In other words, while the temperatures reached in atomic explosions are, indeed, very high they are not as high as might be anticipated by one unfamiliar

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Paper

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16—11144-1

with high temperature physics, on the basis of the high energy-release in an atomic explosion.

The temperatures of atomic explosions may be compared with the temperatures in the interiors of stars which range from 10,000,000° to 100,000,000°K. The source of stellar energy is nuclear, also, so that an atomic-explosion may be thought of as a physical situation intermediate between that in the interior of a star, on the one hand, and a TNT-explosion, on the other. However, stars are characterized by a steady-state situation, the very opposite of an explosion. A steady state, impossible for an atomic bomb, because of its extremely high temperature and explosive pressure, is possible in stars because of the huge gravitational and compressive forces. A similarity of stars and nuclear explosions is evidenced by a like manner of escape of energy by diffusion of radiation, from the very hot core of a star, on the one hand, and from the core in the fireball of a nuclear explosion, on the other.

§2. <u>The Energy Release.</u>

When U^{235} and Pu^{239} nuclei are fissioned by <u>slow</u> neutrons, eighty-nine percent of the available energy is released promptly, and eleven percent is set free after the explosion as energy of beta and gamma rays produced in the delayed radio-active decay of the fission fragments. See Table 1. When fissioned by the fast neutrons produced in atomic-bomb explosions, the energy distribution is somewhat different from Table 1 but the general principle is the same: a very great release of energy in a restricted volume in a very short time.

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The energy released by the A-bombs dropped on Hiroshima and Nagasaki was equivalent to the energy released in an explosion of 20 kilotons of TNT. The source of information on which this paper is based, "The Effects of Atomic Weapons"(2), (3) describes effects of a 20-kiloton fission-bomb. Larger and more efficient (from the point of view of energy-release per kilogram of fissionable bomb-substance) have been made and tested since World War II. The energy-release of the thermonuclear H-Bomb is discussed in terms of megatons (10^6 tons) of TNT.

The energy released in an explosion of a 20-kiloton TNT-bomb is 2×10^{13} calories. This release results from the fission of 1 kilogram (2.2 pounds) of U^{235} if all U nuclei are fissioned. Since the density of U-metal is 18.7 g/cm^3, 1 kilogram of U has a volume of 53.5 cm^3 (about 3 cubic inches). All of the U^{235} or Pu^{239} charge of a bomb is not fissioned, but, figures on fission-efficiencies are unavailable, classified data. We may be certain, however, that the 2×10^{13} calories is released in a small volume so that the energy-density is very high when the nuclear reaction is complete - of the order 10^{10} to 10^{11} cal/cm^3.

A fission-explosion is completed in a few $\times 10^{-8}$ second. In a time this short, the high pressures in the nuclear core do not have time to produce an appreciable dispersion of the bomb case or nuclear core because any displacement which is of the order (acceleration)xt^2, must be very small, even though the accelerations are very great, since t is so very small. At the instant of completion of a nuclear explosion, therefore, practically all the energy released is confined in the original volume of a few cubic inches.

§3. The Initial State Immediately After the Nuclear Reaction.

In spite of the very short duration of the nuclear reaction there is an approach to thermal equilibrium in the nuclear core of the bomb so that before an appreciable dispersion of the bomb can take place there is approximately equilibrium distribution of energy between matter and electromagnetic radiation. At temperatures of 10-million °K, U atoms and ions move with mean-speeds of the order of 3×10^6 cm/sec; protons and neutrons, of the order of 5×10^7 cm/sec; and electrons of the order of 7×10^9 cm/sec. Hence, in a time as short as 10^{-8} second, particles collide a very great many times in matter with a density of 5 g/cm^3 (the normal density of U is 18.7) at 10^7 degrees K. This is necessary for equilibration of the energy of matter and radiation.

At temperatures of 10-million degrees K, atoms of low atomic weight are ionized down to bare nuclei. Atoms, as heavy as U-atoms, are stripped of their electrons down to the L-shell and there is even appreciable ionization of the L-shell. As a consequence of this heavy ionization, the number of free particles, capable of gas-like motion and absorbing kinetic energy $3kT/2$, is many times the number of neutral U-atoms. Instead of a gas-kinetic pressure and specific heat of $p = NkT/V$ and $C_v = 3Nk/2$, respectively, where N is the number of neutral atoms introduced into the bomb-core, we have $p = N'kT/V$ and $C_v = 3N'k/2$ where N' is 40-80 times N. The kinetic energy of the free electrons is a large reservoir for energy released in the explosion. But just the freeing of electrons by ionization of atoms and ions involves the absorption of a large amount of energy and contributes greatly to the heat

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capacity of the bomb core. Electronic excitation of ions, also, makes a large contribution to the heat capacity. Taken together, ionization of atoms and ions, electronic excitation of ions and kinetic energy of free electrons, make the high temperature thermal capacity of the nuclear core very large, indeed, and limit the initial temperatures reached in a nuclear explosion. This is the explanation for the large difference, referred to in Section 1, between the ratio of the initial temperatures reached in atom-bomb and TNT explosions, on the one hand, and the ratio of the energy-releases, on the other.

Ordinarily, the heat capacity of electro-magnetic radiation is ignored because it is so very small. The heat capacity of black-body radiation is

$$\frac{d}{dT}\left(\frac{4}{c}\sigma T^4\right) \quad \frac{\text{energy}}{\text{cm}^3 \cdot \text{deg K.}} \qquad (3\text{-}1)$$

where c is the velocity of light, and σ is the Stefan-Boltzmann constant. At 10,000,000°K. however, this heat capacity is considerable, and at temperatures of 60,000,000°K it is so large that the ordinary heat capacity of matter may be neglected in comparison with it.

The equations for the pressure P and density of energy E in a nuclear core, assuming a condition of equilibrium between the particle-motions and the radiation, are:

$$P\ (\text{megabars}) = 965\ \frac{\rho}{A}\ T + 46T^4 \qquad (3\text{-}2)$$

$$E\ (\text{megajoules/cm}^3) = 145\ \frac{\rho}{A}\ T + 13.7\ T^4 \qquad (3\text{-}3)$$

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where ρ is the ordinary density in grams/cm^3,

T is temperature in kilo-electron-volts, and

$\bar{A}$ is the average atomic weight (grams) of free particles.

$$\bar{A} = \frac{\text{(average atomic weight of chemical elements)}}{\text{(number of free particles per atom)}}$$

The bar is a pressure of 10^6 dynes/cm^2 and is approximately equal to normal atmospheric pressure, hence a megabar is approximately 10^6 atmospheres. A temperature of 1 electron-volt is 11,600°K and a temperature of 1 kilo-electron-volt is 11,600,000°K.

Equations (3-2 and -3) for the pressure energy-density contain two terms: the first, is for the translational motion of free particles, and, the second, for the radiation. There follows a comparison of free particle and radiation properties for 3 different temperatures. It is assumed that $\rho/\bar{A} \sim 1$ cm^{-3}.

a. For T ~ 11,600,000°K (i.e. 1 Kev):

$$\frac{\text{(particle kinetic pressure)}}{\text{(radiation pressure)}} \sim 20$$

$$\frac{\text{(kinetic energy of free particles}}{\text{(radiation energy)}} \sim 10$$

b. For T ~ 34,800,000°K (i.e. 3 Kev):

$$\frac{\text{(particle kinetic pressure)}}{\text{(radiation pressure)}} \sim \frac{2}{3}$$

$$\frac{\text{(kinetic energy of free particles)}}{\text{(radiation energy)}} \sim \frac{1}{3}$$

c. For T ~ 58,000,000°K (i.3. 5 Kev):

$$\frac{\text{(particle kinetic pressure)}}{\text{(radiation pressure)}} \sim \frac{1}{6}$$

$$\frac{\text{(kinetic energy of free particles)}}{\text{(radiation energy)}} \sim \frac{1}{12}$$

In thermoculcear (H-bomb) explosions, temperatures in excess of 5 Kev must be reached because at lower temperatures the rate of the thermonuclear reaction would be so slow that dispersion of the matter and energy would proceed faster than the nuclear reaction.

The importance of thermal radiation in atomic explosions is shown by the fact that a third of the energy released in the explosion escapes from the bomb as thermal radiation. In TNT explosions, temperatures are much lower (~ 5000°K or 4 to 5 x 10^{-4} Kev), and, consequently, there is comparatively little radiation.

d. The Radiation-Front Expansion of the Fireball for 100 Microseconds.

After the nuclear reaction, the small fire-ball starts expanding and dispersal of the bomb proceeds. From the preceding discussion, it is clear that this begins with a small (few cubic inches) core at a very high pressure and energy-density. In the first 100 micro-seconds (10^{-4} sec.) after detonation of a 20-kiloton bomb, the fire-ball expands by a radiative process, that is the radiation advances faster than the material or pressure-shock front. Escaping radiation is absorbed by the surrounding matter, first by the bomb case and later the atmosphere outside. The base and surrounding atmosphere raised to a high temperature by the absorbed radiation, become part of the fire-ball and enlarge it.

If it is not surprising that the radiation expands faster than the matter in the fire-ball because the speeds of material particles can not possibly exceed the speed of light (3×10^{10} cm/sec), no matter how high the temperature, it may seem surprising that at a later stage (at 10^{-4} sec) a material, pressure-shock passes out through the fireball and runs ahead of the escaping electromagnetic radiation. This occurs in spite of the fact that material speeds can not exceed 3×10^{10} cm/sec. It is the physics of this interesting reversal of rates of propagation of the fire-ball that forms the principal part of this paper.

The radiation-front during this first 100 microseconds is at the outer surface of the fireball. Radiation escaping the front is absorbed in the immediately surrounding atmosphere raising it to the high temperature of the fireball-surface of which it then becomes a part. As the radiation-front thus expands, there is a radiative transport of energy from inside the fireball to its surface that proceeds by absorption of photons and reemission of them by radiatively excited ions repeated many times with a very high frequency. The direction of reemission of a photon by an excited atom or ion bears no relation to the direction of travel of the incident-absorbed photon. Photons travel broken paths through the fire-ball, in the emission-absorption-reemission cycle, resembling the random-walk trajectories of gas-particles in thermal motion. The speed of a photon, therefore, is not 3×10^{10} cm/sec in a long straight line; it is 3×10^{10} cm/sec along a very broken line. Photons, therefore, flow to the surface by the comparatively slow diffusion process described by the diffusion equation, well-known in theoretical physics.

$$\frac{\partial \eta}{\partial t} = D_\eta \nabla^2 \eta \qquad (4\text{-}1)$$

where η is the density of photons, i.e. the number per unit volume, D is the diffusion constant for photons in the fire-ball and ∇^2 is the differential, Laplacian operator equal to $(\partial^2/\partial x^2 + \partial^2/\partial y^2 + \partial^2/\partial z^2)$ for Gastesian coordinates[4]. The photon-density, η is related[5] to the radiation-density, $4\sigma T^4/c$. Equation (4-1) is closely related to the well-known equation for heat-conduction:

$$\frac{\partial T}{\partial t} = \frac{k}{\rho C_v} \nabla^2 T \equiv D_T \nabla^2 T \qquad (4\text{-}2)$$

where $k/\rho\, C_v$ is the thermal diffusivity, D_T.

The familiar wave-equation:

$$\frac{1}{c^2}\frac{\partial^2 \vec{\mathcal{E}}}{\partial t^2} = \nabla^2 \vec{\mathcal{E}} \qquad (4\text{-}3)$$

where $\vec{\mathcal{E}}$ is the electric intensity and c, the velocity of light for propagation of radiation through non-absorbing space is not valid here.

The kinetic-theory value for the conductivity, k, of a gas is $\rho C_v \bar{\ell} \bar{v}$, where $\bar{\ell}$ and $\bar{v}$ are the mean free-path and speed of gas molecules in thermal motion. Hence, for the thermal diffusivity of a gas:

$$D_T = k/\rho C_v = \bar{\ell}\,\bar{v}/3 \qquad (4\text{-}4)$$

The diffusion constant D_η for photons in Equation (4-1) is, by analogy equivalent to $\bar{\ell}\, c/3$, where c is the velocity of light and $\bar{\ell}$, the mean free-path of photons in the fire-ball, that is the mean-distance of travel between emission and absorption.

The heat-flux by conduction is:

$$\text{(heat flux)} = K \nabla T = \left(\frac{K}{\rho C_v}\right) \nabla (\rho C_v T)$$

$$= D_T \nabla E \qquad (4\text{-}5)$$

where ∇ is the gradient operator, which in Cartesian coordinates is: $(\vec{i}\,\partial/\partial x + \vec{j}\,\partial/\partial y + \vec{k}\,\partial/\partial z)$.

By analogy, we write for the fireball

$$\text{(radiation flux)} = D_\eta \nabla \text{ (radiation density)}$$

$$= \frac{\bar{\ell} c}{3} \nabla \left(\frac{4\sigma}{c} T^4\right)$$

$$= \left(\frac{4\sigma}{3}\right) \bar{\ell} \nabla T^4 \qquad (4\text{-}6)$$

The mean free-path of $\bar{\ell}$ a photon is equal to the reciprocal of its absorption coefficient μ in the equation:

$$I = I_o e^{-\mu x} = I_o e^{-x/\bar{\ell}} \qquad (4\text{-}7)$$

Mean-free paths of the photons may, therefore, be calculated from absorption measurements. The absorption curve in Figure 2 for long wavelength radiation in normal air does not fit the fireball situation. In the early development of the fireball, the energy-mean wavelength of the fireball radiation is in the soft X-ray region. This should be apparent from Table 2 values of the wavelength, λ_{max}, of maximum energy-

density of black-body radiation. The absorption coefficient of soft X-rays is roughly proportional to the density of the matter traversed and to the cube of the wavelength of the X-rays:

$$\mu \sim (\text{const})\, \rho \lambda^3 \qquad (4\text{-}8)$$

Setting the energy-mean λ for absorption in the fireball proportional to $1/T$, which is only a rough approximation:

$$\bar{l} \sim (\text{const.})\, T^3/\rho \qquad (4\text{-}9)$$

Eq. (4-6) for the radiation flux becomes

$$(\text{Radiation flux}) \sim (\text{const.})\, T^3 \nabla T^4$$
$$\sim (\text{const.})\, T^6 \nabla T \qquad (4\text{-}10)$$

A comparison of this equation with equation (4-5) for the heat flux is interesting. Whereas the heat flux is proportional to the gradient of T, the radiation flux is proportional to the gradient of T^7 or to T^6 times the gradient of T. This has two interesting consequences:

(1) The growth of the fireball is dependent upon the diffusion of radiation from the interior to the surface of the fireball. As the fireball expands it must cool since the energy released by the explosion is filling an increasing volume. Consequently, both the temperature T and the gradient of T in the fireball decrease. Equation (4-10) shows that the flux of radiation to the surface of the fireball must diminish, and the rate of growth of the fireball, also. It is understandable, therefore, that at a later stage of fireball growth that the rate of advance of the radiation-front will be smaller than the speed of an air-

UNITED STATES DEPARTMENT OF COMMERC
National Bureau of Standards
Washington, D.C. 20234

February 24, 1976

hold for manuscript from NBS

of pressure-shock. This occurs 10^{-4} second after detonat

radius of the fireball is about 50 feet and its temperat

pressure-shock then leaves the radiation-front and

the radiation-front as cooling of the fireball pro

(2) From Eq. (4-10) it is clear that the f

spherical surface, of radius r, in the fireb

the explosion, is proportional to

$$r^2 \rho \frac{dr}{dr}$$

oncentric surfaces

to write

Tolly — did attached go out?

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

hold for manuscript from NBS

February 24, 1976

Dr. Edward Teller
Lawrence Livermore Laboratory
Box 808
Livermore, California 94550

Dear Dr. Teller:

The time is fast approaching for your lecture and I would like to remind you of our arrangements for handling your expenses. I am enclosing a sample statement to be submitted along with your manuscript. I would much appreciate your using the sample verbatim in order to expedite our procurement procedures. My secretary, Janet Hydorn, will be in touch with your office in a few days to estimate your travel expenses on March 11. This will enable us to reimburse you for your travel at the time of your visit, and separately from the payment for the manuscript.

We are looking forward to a very successful series of lectures. The response to our brochure has been considerable, and we are expecting a large number of outside visitors.

Sincerely yours,

Robb Thomson

Robb Thomson
Assistant for Scientific Affairs
Office of Programs

Enclosure

Tally did attached go out?

____
Date

For preparation of a manuscript, "____

____",

presented to NBS on______________________________, as part of the 75th

Anniversary Celebrations.

____
Signature

2

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

APR 01 1976

Dr. Edward Teller
Lawrence Livermore Laboratory
Box 808
Livermore, California 94550

Dear Dr. Teller:

I would like to express my gratitude for your lecture which initiated our anniversary series on March 11. As you must have surmised from the warm ovation at the end of your lecture, you touched many responsive chords. In addition to the standing-room-only crowd, more than 100 people watched on closed-circuit television in a nearby lecture hall. We have had numerous requests for a showing of the videotape of your lecture.

I appreciated your remarks regarding NBS and the role it has played in the past as well as your charge to us for the future. Clearly, all of us in the scientific and technical community face a future challenge greater than any we have faced in the past. I was particularly pleased with your characterization of the history of the coupling between science and technology, and of the need for the two to be closely joined in the future.

You asked about Dr. Fred Mohler, who was in charge of the NBS colloquium during the period you were in Washington. Dr. Mohler died in December of 1974.

We are planning a monograph to record the lectures in this series. It will be a unique and valuable document, and on the basis of responses to date, we are sure it will be in great demand.

Let me extend my personal thanks and deep appreciation for your contribution to our anniversary celebration.

Sincerely,

Ernest Ambler

Ernest Ambler
Acting Director

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

March 12, 1976

Dr. Edward Teller
Lawrence Livermore Laboratory
Box 808
Livermore, California 94550

Dear Dr. Teller:

In the rush of events yesterday I neglected to give you your travel expenses. Enclosed is a personal check in what I hope is the proper amount. We will be back to you shortly with your draft manuscript.

Let me say again how pleased we all were to have you with us.

Sincerely yours,

Robb

Robb Thomson
Assistant for Scientific Affairs
Office of Programs

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

March 11, 1976

Dr. Edward Teller
Lawrence Livermore Laboratory
Box 808
Livermore, California 94550

Dear Dr. Teller:

I had the privilege of hearing you this morning at NBS and it would be superfluous for anyone to add compliments to the applause you so richly deserved.

I have been involved in technology all my life and, like so many others, I am concerned about the present health of technology in the United States. I thought you might be interested in the testimony I gave before a Congressional Committee last year because it cites some facts and figures that may be of interest to you.

I am also enclosing a list of some important technical contributions of this century which were not made in large corporations. The only two that I am familiar with were the transistor of Bell Laboratories and modern Television at RCA.

I am also enclosing a sheet from a Canadian Government publication showing who makes what kinds of inventions.

Thank you again for giving us a very exciting and memorable morning.

Sincerely yours,

J. Rabinow

Jacob Rabinow
Chief Research Engineer
Institute for Applied Technology

3 Enclosures

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

Pending - March 12

December 11, 1975

file

Dr. Edward Teller
Lawrence Livermore Laboratory
Box 808
Livermore, California 94550

Dear Dr. Teller:

I appreciate your patience in working with me in settling the abstract of your talk during the past few days. The current exercise was in connection with a brochure for announcing the lecture series.

I am sorry to find that we have not clarified the financial situation relative to your participation in the series in our previous correspondence. As I told you on the telephone initially, we will reimburse you $500 for your manuscript. In addition, we will reimburse all of your expenses for travel to the Bureau at the time of your lecture. As the time approaches, I will work out with your secretary an estimate of your travel expenses so that payment can be made at the time of your visit. When the manuscript is completed, we will then forward the additional $500.

Your abstract promises a very stimulating lecture, and we are looking forward to your visit.

Sincerely yours,

Robb Thomson

Robb Thomson
Assistant for Scientific Affairs
Office of Programs

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

February 4, 1955

Dr. R. D. Huntoon
Associate Director for Physics
National Bureau of Standards
Washington 25, D. C.

Dear Dr. Huntoon:

Thank you for your letter of February 1. It was a great disappointment to me not to be able to attend the February 3 meeting.

I would like very much to stay in touch with the Bureau, and it appears reasonable to assume that I could be available as a consultant upon the occasions when I am in Washington. Upon that basis, I should appreciate your keeping me informed of the dates of meetings, and your making arrangements for a consulting agreement.

Sincerely,

Edward Teller

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.
30.20
22-55

*

February 1, 1955

Dr. Edward Teller
Radiation Laboratory
University of California
P.O. Box 808
Livermore, California

Dear Dr. Teller:

Thank you for your letter of January 18. The whole committee and related NBS staff were looking forward to your attendance and to your helpful and stimulating advice. It is a disappointment to learn that you will be unable to attend.

I know I speak for all of us here when I say that we regret to see your year of service come to an end. This leads me to inquire if this need be so. While your formal appointment to the PCM committee has ended I would like, with your permission, to keep you informed of the dates of the meeting of the Mathematics and Physics committees and hope that you might arrange to attend some of them. In any case, if you are agreeable, I would like to make arrangements for you to serve as a consultant to assist in the planning of the physics and mathematics program at the National Bureau of Standards. We could arrange the dates to your convenience so that your visits here could coincide with your other trips. I will appreciate your reaction to such an arrangement.

In reply to your question about the date of the next PCM meeting, after due canvassing of all concerned, it appears that February 3 is the best all around time and the chairman has decided to go ahead with that date. Dean Rees indicated to me that she plans to write you separately about getting your summary of the situation.

Sincerely yours,

R D Huntoon

R. D. Huntoon
Associate Director for Physics

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.
30.20
94-55

*

April 11, 1955

Dr. Edward Teller
Radiation Laboratory
P.O. Box 808
Livermore, California

Dear Dr. Teller:

Because of your interest in the mathematics program of this Bureau and in particular our exploitation of high-speed digital computers, we would be pleased to have you attend the next meeting of the PCM-NBS Technical Advisory Committee scheduled for May 2 at 9:30 A.M. in Room 301 South Building of the National Bureau of Standards.

The purpose of this meeting is to consider the system design and cost analysis for an electronic digital computer to strengthen the computation facilities at the Bureau. This computer was discussed at the last meeting in connection with the survey on computational needs of the Bureau's technical staff requested by that committee.

We would appreciate knowing whether or not you plan to attend the meeting. It is our hope that your schedule will permit you to do so.

Sincerely yours,

R. D. Huntoon

R. D. Huntoon
Associate Director for Physics

cc: Dean Rees

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.

April 11, 1955 12.0

*

AIR MAIL

Prof. Edward Teller
% Radiation Laboratory
Box 808
Livermore, Calif.

Subject: Development of a Very High Performance Electronic Computer

Dear Professor Teller:

This is a continuation of the earlier correspondence regarding the development of a very high performance electronic computer. By now you probably have received notice of the proposed meeting of the Mathematics Advisory Group for Monday, May 2. This has been purposely scheduled to follow immediately after the Washington meeting of the American Physical Society. At this meeting, members of the National Bureau of Standards staff are planning to present the objectives and the planned approach to a machine suitable for the Bureau's long-term needs in its Physical Science Program.

I checked with Dr. Huntoon's office to learn if they knew of any plans that you had that would bring you to NBS in your official consultant capacity in the near future. They had no information, and for this reason I am writing to you. I am scheduled to be in Berkeley on Wednesday, April 20, for my part of the lecture series on "Automation in Business and Industry." In the event that your plans do not permit you to come to Washington in the near future, I wonder if I might use this opportunity to meet with you or members of your staff to discuss problems of mutual interest in the machine development field. I expect to remain on the West Coast for Thursday and Friday of that same week. Perhaps some convenient arrangement might be made for a brief exchange of views.

However, if you do plan to attend the meeting on May 2, far better coverage would be given and I strongly recommend this in lieu of any informal get-together. Inasmuch as I will probably be enroute by the time you could have replied to this letter, I would appreciate

receiving an indication of your preference when I arrive on the West Coast. I plan to go directly to the Dracker Hotel, Westwood Village, 10824 Lindbrook Drive, Los Angeles 24, California, and your message could easily reach me there.

I hope that this belated correspondence will not inconvenience you in the event that arrangements for an informal discussion are to be made.

Very truly yours,

S. N. Alexander

S. N. Alexander, Chief
Data Processing Systems Division

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.
30.20
73-55

*

March 25, 1955

Dr. Edward Teller
Radiation Laboratory
University of California
P.O. Box 808
Livermore, California

Dear Dr. Teller:

We were delighted to receive your letter of February 4, 1955 in which you indicated your willingness to serve as a consultant to the National Bureau of Standards.

I have delayed my reply until we could get the appointment set up and all paper work completed. This has now been done and we are looking forward to your first visit.

The Technical Advisory Committees for Physics and Mathematics have both been advised of your willingness to serve as an NBS consultant and both will welcome your presence at their meetings when you can arrange to attend.

The next meeting of the Physics Committee will be on Saturday April 30 at 9:30 A.M., South Conference Room at the National Bureau of Standards. Hope you can make it.

This letter will serve as notice that your appointment has been approved. As a consultant you are entitled to travel from your home or place of business at government expense to the National Bureau of Standards. You will also be entitled to the usual per diem allowance and compensation at the rate of $50.00 per day while on duty. As you probably know, this is the top consulting fee we are allowed to pay. In order to complete our records, it would be appreciated if you would inform us of your home address.

If you will indicate when you wish to pay us your first visit, we will arrange travel orders and forward government transportation requests for your use. If you prefer to handle the travel reimbursement on some other basis, please indicate your preference. It will be necessary for you to sign a few papers on arrival to formalize your appointment but

it will not be required that you fill out any additional forms.

We sincerely appreciate the opportunity to have your advice and assistance and wish to do all we can to streamline the arrangements.

Sincerely yours,

R. D. Huntoon

R. D. Huntoon
Associate Director for Physics

April 18, 1955

Dr. R. D. Huntoon
Associate Director for Physics
National Bureau of Standards
Washington 25, D. C.

Dear Dr. Huntoon:

Dr. Teller has been out of town rather frequently, recently, and on Friday, when he was in Livermore, I am afraid he did not have sufficient time to read your letters very thoroughly. He did ask me, however, to tell you that he will not be able to attend the meeting of the Physics Committee on Saturday, April 30.

Furthermore, inasmuch as Dr. Teller is unable to go to the meetings of the American Physical Society, it seems very unlikely that he will manage the May 2 meeting of the Mathematics Advisory Group. However, Dr. Teller does plan to be in Washington for a few days the week of May 9, and will wish to get in touch with you and other members of the groups at some time during that week. I will let you know just as soon as his plans are crystallized.

Dr. Teller's home address is 1573 Hawthorne Terrace, Berkeley, California. I believe it would be somewhat simpler for us to initiate any travel arrangements here at the Laboratory, and subsequently to request reimbursement from you, when necessary, rather than for you to forward TR's.

Arrangements are being made for Dr. Alexander and Dr. Teller to meet on Wednesday, April 20, for informal discussions on the development of a very high performance electronic computer, in Berkeley, since Dr. Teller can not get to Washington for the meetings.

Dr. Teller appreciates your many courtesies and regrets very much that his schedule has so far not permitted him to attend the meetings of the Technical Advisory Committees.

Very truly yours,

Ruth P. Brockett
Secretary to Edward Teller

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

February 21, 1955

IN YOUR REPLY
REFER TO FILE NO.
3.0

*

Dr. Edward Teller
Department of Physics
University of California
Berkeley, California

Dear Edward:

This is to let you know that I received a letter today from C. L. Marchall, Deputy Director of Classification, AEC, confirming my conversation of February 14 with him that my paper "Temperatures in Atomic Explosions" does not contain Restricted Data. This is the paper I sent you on February 2. I am sending you a duplicate copy of the letter I received.

If you have any suggestions for following up on this paper or for improving it, I shall very much appreciate your suggestions.

We were all very happy to get Mici's letter about the results of her examination. We hope that soon she will be well and strong again.

With best regards,

Sincerely yours,

Ferdinand

F. G. Brickwedde, Chief
Division of Heat and Power

Enclosure

The paper is attached -

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C.

IN YOUR REPLY
REFER TO FILE NO.

February 2, 1955

3.0

* Dr. Edward Teller
Department of Physics
University of California
Berkeley, California

Dear Edward:

I am enclosing a copy of my paper on "Temperatures in Atomic Explosions" presented at the Temperature Symposium in Washington last October.

I have submitted a copy of this paper to Dr. Daniel J. Pflaum for clearance which has not yet been received, however, I anticipate no difficulties with clearance because I submitted earlier a rough draft of the paper for clearance. As soon as I have definite word from Dr. Pflaum I shall communicate it to you.

I shall appreciate very much any suggestions you may have on following up the subject of the enclosed paper. I have read two classified documents in the Atomic Energy Commission building downtown which contains classified matter that could not be put into my unclassified paper. I wish it were possible to make use of atomic explosions for investigations of high temperature physics. I have no proposals to make along this line and would appreciate any suggestions that you might make. If there are any errors, weaknesses or inconsistencies in the enclosed paper, I shall appreciate very much you telling me of them as I still have an opportunity to change the paper.

In the last issue of the "Scientific American" there was an article on the bubble cloud chamber by Glaser of the University of Michigan. I would be pleased if I could be of some help with a liquid hydrogen bubble chamber. It sounds very interesting and I should like to continue some activity in cryogenic engineering for which I have no other opportunity now.

We are all very much concerned about Mici. We had a letter from her recently. We would like to hear the results of the examinations.

With best regards.

Sincerely yours,

Ferdinand

F. G. Brickwedde, Chief
Division of Heat and Power

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

February 4, 1977

Marked corrected galley proof to NBS 2-15-77

Dr. Edward Teller
Lawrence Livermore Laboratory
Box 808
Livermore, California 94550

Dear Dr. Teller:

Enclosed is a copy of the galley proof of your article for our 75th anniversary volume. In order to expedite matters I will call you in about a week, and hopefully we should be able to take care of any problems arising over the phone.

Sincerely yours,

Robb Thomson /g.h.

Robb Thomson
Senior Scientist
Office of Programs

Enclosure

Dr. Edward Teller is University Professor Emeritus of the University of California, Associate Director at Large Emeritus of the Lawrence Livermore Laboratory, and Senior Research Fellow of the Hoover Institute on War, Revolution, and Peace of Stanford University. He has made pioneering contributions in a wide range of science and technology. His well-known work in the development of thermonuclear weapons was preceded by earlier fundamental work on thermonuclear reactions. He has also made major fundamental contributions to the quantum theory of polyatomic molecules, and still maintains a continuing interest in molecular and nuclear physics. In addition, Dr. Teller helped develop national programs to explore methods of processing thermonuclear energy by means of both magnetic confinement and laser techniques. He is a member of the National Academy of Sciences, and the Commission on Critical Choices for Americans, the President's Foreign Intelligence Advisory Board, and the Board of Directors, University of Tel Aviv. He has received the Joseph Priestly Memorial Award, the Albert Einstein Award, the Enrico Fermi Award, and the Harvey Prize of ~~Tel Aviv University~~ the Technion at Haifa.

226-551

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it is now in Western Europe. The energy was, of course, mostly derived from wood, which was there for the burning: the more you burned, the better. The other source was hay for the horses and "horsepower." This latter provided one-third of the energy. But energy even at that time was consumed in the United States much more copiously than it is today almost anywhere in the world.

Apart from being so rich in energy we have a very peculiar problem in this country: size, and the difficulties which come with physical size. One very interesting story of how size has affected America is connected with the Governor of New York and the attempt at the beginning of the 19th century to open up the Far West—the Far West (meaning Buffalo). As Governors of New York usually do, DeWitt Clinton established a commission. On that commission there served a man by the name of Colonel John Stevens, who said, "I have heard of a man in England; I think his name is James Watt. He has built a steam engine. In this country, we have had rails in mines for a long time. Could we not put one of James Watt's engines on such rails in order to get to Buffalo?" Nobody believed him. Quite a few years later, and three years before Stevenson's "Rocket," Colonel John Stevens demonstrated the first locomotive on his own farm. But the New York commission said no.

The commission decided instead on the Erie Canal, and the proposal went to Washington for approval. The President of the United States at that time said that to dig a canal, hundreds of miles long, through wil-

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derness, was an idea which was premature at least by one century. The President of the United States who said that was, surprisingly enough, Thomas Jefferson!

Whereupon the Governor of New York went ahead with the canal project by means of that marvelous recent invention of Adam Smith, private enterprise. The bonds were subscribed, the Canal was dug. It was not the longest canal in the world—the Chinese had done better almost 2000 years earlier. The Canal was finished in the 1820's, quickly paid off all its debts, and made a profit. But 15 or 20 years later, it was put out of business by competition with the railroad which had been suggested by John Stevens in the first place.

These days, when I go to bed, desperate because an additional incredible blunder has been made in Washington, I like to remember that story.

In those days, America was not yet industrialized. Still it had probably as many steam engines as all of Western Europe. Because of the riverboats, and then later the railroads, steam engines were needed to overcome the distance. Another step in the same direction was the early use of the telegraph in the United States. It was much more important here than in Europe where communications over the shorter distances were much easier.

Among many others, there is a third specific accomplishment of the United States that I want to mention. This third accomplishment is tied to the name of Eli Whitney, and I do not have in mind the cotton gin. Eli Whitney pioneered the proposition that one could get money out of the Defense Department. He got a contract for making guns. Not only did he make that breakthrough, he also failed to deliver in time, overran his budget and still continued to get money out of Washington. When the early predecessor of the Pentagon became impatient with him, asking him to bring in some guns—he arrived in Washington with a sack. When he opened the sack, there were no guns. Asked, "Where are the guns?" he said, "These are ten guns; just put them together." There in the sack were interchangeable parts. Apart from some very early attempts in Venice, this was a brand new approach which Eli Whitney made to work only in a halting and ineffective way. But it was a beginning. From there, of course, came the bicycles and the sewing machines and the typewriters, and in the end, even Henry Ford's automobiles.

Not only was genius at work in the case of Eli Whitney; of that there can be little question. But there was also something else at work—something connected with necessity, and a reasonable reaction to a challenge. The industrial revolution—real industrialization—came to the United States only in the second half of the 19th century, even a little later than mid-century. The remarkable thing is that labor in the United States was then twice as expensive as in England, and in England, in turn, people were better paid than in continental Europe. Yet America managed to compete. The higher wages were, of course, due to the fact that anybody could go out West and get land. A man in America in those days did not need to

226-551
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Thomas Jefferson!

Whereupon the Governor of New York went ahead with the canal project by means of that marvelous recent invention of Adam Smith, private enterprise. The bonds were subscribed, the Canal was dug. It was not the longest canal in the world—the Chinese had done better almost 2000 years earlier. The Canal was finished in the 1820's, quickly paid off all its debts and made a profit. But 15 or 20 years later, it was put out of business by competition with the railroad which had been suggested by John Stevens in the first place.

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$$\int_0 \left[\int_0 |F(q,w)|^2 dw - Zf^2(q)\right] \frac{d^3q}{4\pi q^2}$$

...f(q) is the proton form factor and Z the charge of ...) is already known and F(q,w)2 can be measured at NBS

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

December 10, 1974

241.00

sent copy N/E Tom trip 3/11

Dr. Edward Teller
Assoc. Dir. at Large and For Physics
University of California
Lawrence Livermore Laboratory
P. O. Box 808
Livermore, California 94550

Dear Edward,

I regret that circumstances did not permit you to stay for lunch during your recent visit to NBS as I had hoped to get your opinion on some of the activities of the Nuclear Sciences Division.

An item which I thought might be of considerable interest to you, owing to your long interest in sum rules, is the work of Drs. O'Connell and Lightbody of NBS. In studying properties of form factors measured in electron scattering, they discovered a sum rule which permits one to measure absolutely the Coulomb energy of the nucleus--not the Coulomb energy difference but the total Coulomb energy. This is the first method which we are aware of which permits this measurement. It appears to be applicable to any nucleus.

Briefly, the procedure can be expressed in terms of the form factor for electron scattering, F(q,w), defined by the expression

$$\frac{d^2\sigma}{dRdw} = \sigma_{mott}|F(q,w)|^2$$

where q is the momentum transfer and w the energy. O'Connell and Lightbody have discovered that the following integral over the form factor leads to the total nuclear Coulomb energy.

$$E_c = \frac{e^2}{\pi}\int_0^\infty \left[\int_0^\infty |F(q,w)|^2 dw - Zf^2(q) \right] \frac{d^3q}{4\pi q^2}$$

In this expression f(q) is the proton form factor and Z the charge of the nucleus. f(q) is already known and $F(q,w)^2$ can be measured at NBS

using the NBS 130 MeV linac and the associated electron scattering spectrometer. A complete derivation of the sum rule is given in the enclosed preprint.

We are interested in any comments you might have on the uniqueness of this expression, the significance of a systematic study of nuclear Coulomb energy, and the possibility for an analog in atomic physics.

Dr. Mort Weiss of LLL has made arrangements for Dr. O'Connell to consult with the Theoretical Division at LLL. Perhaps you would be able to discuss this with him on one of his visits to LLL.

Sincerely yours,

Charlie

Charles D. Bowman
Chief, Nuclear Sciences Division

Enclosure
Preprint "Momentum Transfer Sum Rules in Electron Scattering"

cc:
J. E. Leiss, NBS
J. S. O'Connell, NBS
M. S. Weiss, LLL

LAWRENCE LIVERMORE LABORATORY

May 7, 1976

Mr. Robb Thomson
Assistant for Scientific Affairs
Office of Programs
United States Department of Commerce
National Bureau of Standards
Washington, D. C. 20234

Dear Mr. Thomson:

Enclosed please find an edited version of the lecture Dr. Teller gave at NBS on March 11. Dr. Teller has chosen to completely omit the question and answer section as you are doing with the other lectures.

I've also enclosed the statement, per your instructions of February 24th.

Sincerely,

Tolly Williamson

Tolly Williamson
Secretary to Edward Teller

Enc.

University of California P.O. Box 808 Livermore, California 94550 □ Telephone (415) 447 1100 □ Telex 34 6407 AEC LLL LVMR □ Twx 910 386 8339 AEC LLL LVMR

1952-1977

IMG_2260

SCIENCE AND TECHNOLOGY IN AMERICA

Dr. Edward Teller
Lawrence Livermore Laboratory

Seventy-five years ago when the Bureau of Standards was established, a very great change occurred, perhaps by coincidence, in the field about which I have to talk. Up to that date, there was almost no connection between science and technology. Even though technology, of course, used the results of science, a real collaboration existed only as an exception ~~and only recently. And only sporadically.~~

Today we can hardly speak about either science or technology without mentioning the other.

I would like briefly to go back into the ~~dark ages, the~~ dark ages in America, when science and technology still went their separate paths. I want to emphasize technology throughout my lecture; even though I came to the United States as a pure scientist and got converted slowly and painfully to technology. Technology in America was something very remarkable, because it was so different even then from technology anywhere else. I would like to highlight this just by telling you a few facts and a few stories.

My first fact is: We are accused today of an indecently high per capita consumption of energy in relation to the rest of the world. In the year 1800, when America was an agricultural society, our energy consumption was even more out of line. In 1800 the per capita energy consumption in the United States was almost as high (I think about 80% as high) as it is now in Western Europe. The energy was, of course, mostly wood, which was there for the burning; the more you burned, the better. ~~and~~ The other source was hay for the horses and horse-power. ~~which~~ This was one-third of the ~~wood~~ energy from wood. But energy even at that time was consumed in the United States much more ~~vigorously~~ copiously than even today it is almost anywhere in the world.

...TES DEPARTMENT OF CO...
...ureau of Standards
...n, D.C. 20234

...OLOGY IN AMERICA

Edward Teller
...e Livermore Laboratory

...when the Bureau of Standards was established,
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UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

April 21, 1976

Dr. Edward Teller
Lawrence Livermore Laboratory
Box 808
Livermore, California 94550

Dear Dr. Teller:

Enclosed is the transcript of your lecture. I have made no attempt to edit it. I presume you will want to keep as much of the spontaneity of your delivery in the final product as possible, so I have left the whole problem of editing to you.

Because of the rather spotty response to question and answer periods of the other speakers, I have decided not to include questions and answers as a formal part of the monograph. Instead, you should include any part you wish of the Q&A portion of your talk in your manuscript.

We continue to get requests for copies of your speech. It has made quite an impact not only at NBS, but throughout the area.

If there is any way I can help, please let me know.

Sincerely yours,

Robb Thomson /J.H.
Robb Thomson
Assistant for Scientific Affairs
Office of Programs

Enclosure